THE DENTAL PRACTITIONER

AND DENTAL RECORD

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AND DENTAL RECORD

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THE DENTAL PRACTITIONER AND DENTAL RECORD

Vol. XI, No. 10 June, 1961

EDITORIAL

ÆSTHETICS IN DENTISTRY

SINCE the days of Fauchard the descriptive words "Art and Science" have been applied to the practice of dentistry. In recent years much has been done to advance the science of dentistry but little to improve the art—indeed it might well be said to have regressed.

In any group of people that one meets there are always some who have had dental restorative procedures carried out on their anterior teeth and it is unfailingly easy to distinguish the false from the natural. With modern technology and equipment one would have thought that these problems of æsthetics would now have been answered. Apparently not.

Why should this be? There is probably no one answer. A combination of factors contributes to the cause. First, the economics of dentistry to-day requires that the patient be dentally fit without necessarily being æsthetically attractive. Secondly, mass production, even in dentistry, causes a lowering of artistic standards. Although present-day equipment, materials, and techniques have led to greatly speeded-up procedures, the time saved would appear not to be devoted to æsthetic improvements. When this is done, very often the results are not justified: the materials available are not of sufficiently high quality to give the hoped-for effect. In this, the dental trade and manufacturers are possibly at fault. Every dentist has experienced the frustration of attempting to obtain artificial teeth which bear a close colour resemblance to the shade guides.

There was a time before the last war when shade guides for synthetic porcelain could be obtained showing the quantities of powder required to make up certain colour variations. Nowadays only guides to the colours of the powders are available. The same holds true for plastic filling materials. Plastic, originally a boon in æsthetic dentistry, has become such devalued coinage as to break the heart of any practitioner who prides himself on his dental art. Its very simplicity of use has probably done more to harm it than anything else. In the hands of some, superb colour matches are obtainable, but these are very rare and generally speaking plastic crowns and denture teeth stand out like "sore thumbs".

Thirdly, the greatly increased volume of prosthetic dentistry now handled in this country has, again, led to a forced lowering of standards on the part of technicians and possibly loss of interest in fabricating restorations, once a source of pride to these assistants. Patients contribute to this general malaise by the ready acceptance of the standard of dentistry they receive.

Surely the time has come to improve our service to the public by matching our art to our science?

PIERRE FAUCHARD

THE FATHER OF MODERN DENTISTRY

By J. MENZIES CAMPBELL,

D.D.S. (Tor.), Hon. F.D.S. R.C.S. (Eng.), F.D.S. R.C.S. (Edin.), F.R.S.E.

Hon. Member: Pierre Fauchard Academy. Honorary Lecturer in the History of Dentistry, University of Edinburgh

As a volcano can unexpectedly erupt, so can a giant arise among men to eclipse all others in a particular sphere. Such was Pierre Fauchard, and to him the dental profession throughout the world is still decisively indebted.

Fig. 1.—Pierre Fauchard.

It is certainly not unique for an egotistical or ruthless person with superficial knowledge to scintillate in an age of mediocrity. However, no one can possibly describe the eighty-three years (1678–1761) of Fauchard's life as a period devoid of practitioners with considerable ability—to cite but a few, Bourdet, Bunon, Capperon, Garengeot, Gérauldy, Jourdain, Lécluse, Martin, Mouton, and Pfaff.

Nevertheless, by sheer merit, Fauchard outshone all of them, successfully surmounted obstacles, and left a deeply chiselled mark which time can never efface. In fact, he was one of the "pioneer souls", about whom S. W. Foss wrote, "that blaze a path where highways never ran".

The bicentenary of the death of this illustrious man will be celebrated on July 1–2 of this year. The French National Committee has certainly arranged a programme worthy of such an important occasion. This includes unveiling a bust of Fauchard in the Château de Grand-Mésnil, which he owned and which remained in the possession of his descendants until 1919.

There will also be a civic reception, a Pierre Fauchard Exhibition in L'École Dentaire de Paris, and a walk in the vicinity of L'École de Médecine, very familiar to this great surgeon-dentist. An outstanding meeting will be held in the Grand Amphitheatre of the Sorbonne attended by members of the French Government, followed by an official banquet in the evening.

Besides, a special postage stamp will be issued bearing the portrait of Pierre Fauchard, and a facsimile edition of his memorable work of 1728.

It is intriguing to realize the fortuitous circumstances that influenced Fauchard to dentistry. In 1693, when aged fifteen, he became a student-surgeon in the King's Navy, where he served for three years. His preceptor was Alexandre Poteleret, a surgeon-major well versed in oral diseases and their treatment.

Endowed with a receptive and adaptable brain, the youthful Fauchard was soon convinced of the vital role of dentistry in the healing art. For this reason, he avidly and carefully studied the findings of those earlier surgeons who had devoted attention to the teeth. Poteleret encouraged him in this pursuit. He was most fortunate to have as potential patients an extensive naval

personnel, with special opportunities to observe scurvy of the gums, then very prevalent among the crews of all sea-going vessels.

It is known that he started practice in Angers in 1696 as a *chirurgien-dentiste*—the first person so to designate himself. Until then even enlightened French dental operators had styled themselves *dentateurs*. He practised later in Nantes, Rennes, Tours, and finally settled in 1719 in Paris, where his clientele included many of the most prominent persons in France.

Fig. 2.—Seventeenth-century French tooth-drawer. (*Menzies Campbell Collection.*)

Let us, therefore, consider some of the achievements which entitle this remarkable man to be universally accepted as "The Father of Modern Dentistry". Genius, foresight, judgement, powers of observation, scientific outlook, and exceptional dexterity were mainly responsible.

Foremost, mention must be made of his epoch-making work, *Le Chirurgien Dentiste*. Although completed in 1723, it was first published in two volumes in 1728. That scholarly and careful dental historian, G. B. Denton, has examined the original manuscript (unearthed by Viau in 1892 in the Library of the Faculty of Medicine) and compared it with the printed work. As an outcome, he is firmly convinced that certain emendations were effected in the intervening five years. This is hardly surprising in a man of Fauchard's calibre, because he was of the type that would not make his work known until absolutely convinced of the accuracy of his findings.

Within three years of its publication, a German translation appeared. There was a second (enlarged) French edition in 1746, and a third, posthumously, in 1786. Incidentally, there was no English translation until that by Lilian Lindsay in 1946.

As suitable professional journals did not exist for reviewing a book such as Fauchard's, he very wisely included in his second edition a number of approbations from surgeons of high repute.

It is extremely difficult to render adequate justice to Fauchard's enlightened influence, which established the practice of dentistry on a scientific basis, thereby creating a landmark in our history.

He stressed the vital importance of preserving the natural dentition, not only for

proper speech but also to ensure efficient mastication and digestion.

Although, since early times, minute worms had been accepted as the causative factor in dental caries, Fauchard remained unconvinced. He stated that efforts to detect them had proved unsuccessful, even with the aid of Manteville's microscopes. However, in the treatment of certain cases of caries of the teeth he adhered to the time-honoured practice of cauterizing with hot irons.

For scurvy of the gums—now popularly termed pyorrhœa alveolaris—he advocated skilfully scraping the teeth, expelling pus by digital pressure, regular cleaning with small sponges (he disapproved of horsehair bristle brushes), and an anti-scorbutic lotion.

Appropriately, Sir William Kelsey Fry commented on Fauchard's advocacy of hypertrophied gum tissue being removed with straight or curved scissors, which should be very sharp and pointed; and stated that, about 1920, this so-called "new" technique was recommended for gingivectomy. This merely confirms that those who are ignorant of history can be expected to repeat it.

Likewise, Fauchard was very enlightened in his views on irregularities of the teeth. Among causes, he mentioned unduly long retention of the primary teeth; also their reckless or untimely extraction resulting in the adjoining teeth gradually drifting together and leaving insufficient space for their successors.

It is, therefore, not surprising that Fauchard was widely recognized as a specialist in orthodontics, and that surgeons freely recommended patients to him. He adopted various modes of treatment with, for example, files, waxed silk thread, and plates or strips of gold. Sometimes he applied torsion prior to digital pressure, but emphasized that considerable caution was then essential. Should it not be possible to restore certain unsightly teeth to proper alinement, he did not hesitate to advise extraction.

His clinical records of actual cases of dental irregularities, including the appliances used, are of considerable interest even to dentists of to-day.

Quite apart, he was an inventive genius who advised a double-ended pelican, an elevator, straight and curved forceps. Incidentally, he never at any time mentioned the key instrument. He was not averse to adapting tools favoured by clock-makers, watchmakers, and jewellers. These embraced the bow-drill, compasses, vices, saws, files, and sculptors.

Besides, Fauchard described and illustrated five types of obturators: (*a*) with two parallel metal-hinged wings, (*b*) minus a hinge, (*c*) attached to a denture, (*d*) ivory, and (*e*) partly bone and partly metal. It is not an exaggeration to state that these have been the bases of subsequent development in this sphere. In fact, James Snell, practising about a century later and extremely proficient in the construction of obturators, paid high tribute to Fauchard's ingenuity and intelligence in such a highly specialized field.

In the eighteenth century, anyone—man, woman, or child—requiring an extraction was seated on the floor, but Fauchard was very opposed to this and advocated an arm-chair.

In his writings he created the impression that transplanting of teeth was a very frequent operation, and successful, provided certain precautions were observed. Fundamentally, he advised restricting such activities to young subjects with healthy oral tissues and firm sockets, but condemned attempts to transplant molars. He also emphasized that the teeth selected should conform as nearly as possible to those about to be replaced.

He devoted considerable space to a discussion on the advantages and disadvantages of the materials and instruments used in the construction of artificial substitutes. Adhering to early eighteenth-century practice, he used not only human teeth but also those fashioned from hippopotamus or walrus ivory.

When extensive restorations were indicated, he mounted teeth on gold or silver bases to which dowels of the same material had been riveted. Should any natural teeth remain, the denture was stabilized to them by means of silk thread or gold wire. In the absence of suitable anchorage, he overcame undue mobility with spiral "springs".

However, Fauchard was not content to construct and fit the prevailing types if he could improve upon them. For example, he made extensive use of enamelled teeth shaded to harmonize with natural ones. In such cases, he first fashioned a gold base to conform to the outline of the oral tissues. Thereafter, strips (depending on the number of teeth to be replaced) of the same material were fitted at right-angles. On these he accurately traced the outlines of the teeth to be substituted. Afterwards the entire structure was sent to an enameller, with careful details as to colour. In the case of a partial restoration, Fauchard invariably summoned such a technician to his rooms to ensure that the shade closely resembled that of the natural ones.

In a couplet, Solyman Brown advised:

> Beware of those whom science never taught
> The hard but useful drudgery of thought.

Pierre Fauchard was assuredly *not* in this category.

It is unfortunate that, although he enjoyed a deservedly high reputation throughout his career, his success incited jealousy among certain unscrupulous pygmies with circumscribed outlooks. Consequently, in the second edition of his book he decided to deny false reports, then circulating, to the effect that he had retired. He courageously added that the obvious aim of such persons was to divert his practice to themselves

When he died in 1761 in his home at rue des Cordeliers, he was succeeded by his brother-in-law, Monsieur Duchemin, who was already a partner.

In honour of Fauchard, L'École Dentaire de Paris founded in 1879 Le Musée Fauchard. To-day this comprises books, prints, furniture, instruments, prostheses, orthodontic appliances, and comparative odontology. Much of it has been donated by private collectors.

Further, it is noteworthy that the first society founded to commemorate this illustrious man was in 1936 in the U.S.A.—the Pierre Fauchard Academy.

It should be borne in mind that the methods in vogue among dental practitioners in Fauchard's time were highly secretive. However, a close study of the writings of this altruist reveals that he was an outstanding humanitarian who freely disclosed his wide knowledge so that colleagues and the public could jointly benefit.

Truly it can be said of Pierre Fauchard that he raised the practice of dentistry from a lowly trade to that of a profession.

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LIP AND TONGUE BEHAVIOUR IN RELATION TO PROSTHETICS

By **D. C. BERRY**, M.D.S., Ph.D.,
and **J. K. WILKIE**, B.D.S.
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INTRODUCTION

THE principles used in dental prosthetics are continually being modified as more is learnt of the mobility and tolerance of the soft tissues, which form a large part of the environment of appliances placed in the mouth.

Unfortunately the movements of these soft tissues are difficult to demonstrate without modifying in some way the conditions under which they normally take place. Even such a small object as a strain gauge, if attached to a tooth, may so alter the tooth contour that the tongue behaviour may be affected. In a similar way, the coating of the mucous surfaces of the mouth with radiopaque pastes in order to visualize these surfaces radiographically may cause alteration of the soft-tissue behaviour. The comparatively recent introduction of the X-ray image intensifier has enabled more evidence to be collected, by radiographic means, concerning certain soft-tissue movements. This equipment has the advantage that under certain conditions the use of a contrast medium is not necessary. However, the technique requires that the subject's head should be held in a fixed and relatively unnatural position, and the results obtained must therefore be interpreted with considerable reserve.

SOFT-TISSUE BEHAVIOUR

Although such methods of examination may appear to have inherent deficiencies, there is no doubt that they are of great value when used in conjunction with clinical observation. Much has already been learnt concerning soft-tissue behaviour by clinical observation alone, and in this connexion the classical papers of Rix in 1946 and 1952 marked the beginning of a new school of thought. Rix suggested that the movement-patterns of the lips and tongue could be divided into different types, and could play a large part in the development of malocclusions. Gwynne-Evans (1954) supported this view, stating that "There appear to be two broad types of swallowing behaviour with many variants between. The one I am tempted to call the 'somatic' type, where there is evidence of selective action among the oral muscles, which allows the contraction of the masseter and temporal muscles to bring the teeth firmly together, whilst the lips and cheeks are left in a relatively passive state; in this case a normal occlusion is usually associated, providing that there are no other factors present to cause malocclusion. The other I am tempted to call the 'visceral' type, where the teeth are not brought together, and the orbicularis muscle and circumoral muscles exhibit a sphincteric or peristaltic form of behaviour as the muscles of the floor of the mouth and tongue contract to squeeze food, and noticeably saliva, backwards towards the pharynx. An abnormal occlusion is usually associated with this form of behaviour even when other prerequisites for a normal occlusion are present. In the presence of a post-normal relationship between the jaws themselves, this pattern of visceral behaviour is usually accentuated and associated with a marked Class II, Division 1 type of occlusion, often with an additional overjet of the upper incisor teeth." This concept is now generally accepted, although some differences of opinion exist concerning the modification of the basic swallowing pattern by treatment, age, and development, and by the adoption of habit postures and movements. Although such matters are normally the concern of the orthodontic specialist, a knowledge of lip and tongue behaviour can be very useful when applied to certain prosthetic problems. And with all due apologies, and solely for the purpose of this short article, it is suggested

that lip and tongue behaviour can be considered separately. It is then possible to classify lip movements into three broad groups:—

1. At rest the lips are held lightly together. During swallowing they remain lightly together, no muscle contraction around the mouth being visible. This, for the purpose of argument, is normal lip behaviour.

2. At rest the lips are held lightly together. During swallowing, muscle activity is seen around the mouth and the teeth are frequently apart. Although the lip behaviour may not be strictly normal, if dynamic balance exists between lips, teeth, and tongue, there may be no clinical abnormality.

3. At rest the lips are apart, but during swallowing there is considerable activity of the circumoral muscles, particularly if the overbite–overjet relationship allows the lower lip to be trapped behind or against the tips of the upper incisors. This lip–tooth contact helps to seal off the anterior part of the mouth during the swallow. This set of circumstances is abnormal.

In a similar way the tongue behaviour during swallowing may be of three types, assuming that the dentition is intact:—

1. The tongue is contained within the dental arches during the swallow, the teeth being together.

2. In order to seal off the anterior part of the mouth during the swallow, the tongue is pushed forward either against or partly between the anterior teeth.

3. During the swallow the cheek teeth are held apart and the tongue spreads laterally between them.

Although these different types of lip and tongue behaviour were first observed and studied on child patients, there is no evidence to show that these behaviour patterns do not, in many cases, continue into adult life. Our own clinical observations suggest that some, at least, even extend into edentulous old age. It is therefore possible to speculate on the effects of abnormal lip or tongue behaviour when considering the replacement of upper anterior teeth by a full or partial immediate denture.

REPLACEMENT OF ANTERIOR TEETH

Unless extreme proclination of the natural upper anterior teeth exists, good mechanical results may usually be obtained by replacing these teeth by artificial ones in the same position. But most patients with even a slight degree of proclination, particularly if their lips at rest are slightly apart, are anxious to take the opportunity of making a change which to them is æsthetically more acceptable. Although it may be a simple laboratory procedure to provide a denture on which the anterior teeth are not proclined, this denture may not be entirely satisfactory. If maximum stability is to be achieved, the teeth on the denture should be in such a position that dynamic equilibrium exists between the soft-tissue movements on each side of them. It is of course impossible to obtain this situation for *all* the movements of the lips and tongue. But the position of the natural teeth, however odd, is probably the result, or perhaps the resultant, of the forces acting on them. Any change in position of these teeth may mean that they will no longer be in balanced equilibrium. Therefore a denture incorporating an æsthetic improvement may be a failure for one or more of the following reasons:—

1. The lips at rest may be held apart by the proclination of the natural upper anterior teeth. An immediate denture with less proclined teeth may allow the lips to come closer together, and the patient, delighted that the teeth are now less obvious, may make no initial complaint. But frequently the æsthetic result is disappointing, the whole face losing its character and becoming depressingly "average". (*Figs.* 1, 2.)

2. The lips may be apart at rest, the natural anterior teeth being proclined by the intermittent pressure of the tongue during swallowing. An attempt to provide an æsthetic improvement may produce a denture which is tipped forwards and backwards during each swallow. If this is tolerated for any length of time, the palate may become chronically inflamed. It is suspected that many cases of palatal inflammation arise in this way. (*Figs.* 3–5.)

3. The æsthetic improvement may not be as great as the patient expects, and he or she may adopt an altered lip-posture in an attempt to hide the teeth. The result can be somewhat disastrous, and the long-term effects of such an adopted habit are difficult to forecast. (*Figs.* 6–8.)

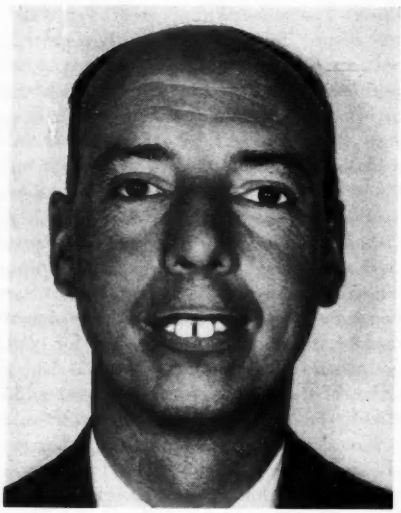

Fig. 1.—Are the lips prevented from closing naturally by the proclined teeth?

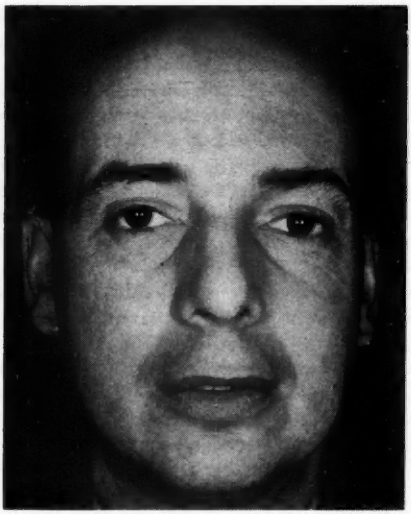

Fig. 2.—The provision of an immediate denture allows the lips to come closer together, but the lively, humorous character of the face is lost, and the lips are still slightly "incompetent" at rest.

It is not always possible to anticipate such failures, for the infinite variability of the several factors, together with the possibilities of associations between each, render the assessment of any particular case extremely difficult. Often it is necessary to construct a denture in order to find out how satisfactory it is. This is not necessarily a policy of defeat, for a knowledge of lip and tongue behaviour will sometimes enable the proper correction to be made if the denture is a failure. It would not be wise, for example, to attempt to stabilize a partial upper immediate denture replacing upper anterior teeth by adding clasps round the natural premolars when a powerful tongue thrust occurs during swallowing. Similarly, a full upper denture for a patient who has an anterior tongue thrust and who has been provided with anterior teeth more posteriorly placed than the natural predecessors may traumatize the palate. If the patient insists on retaining the æsthetic improvement provided by the denture, a highly polished metal palate will minimize the palatal inflammation. (And although this discussion is concerned with upper dentures, a similar traumatic effect can theoretically be produced if a patient with a much resorbed lower ridge is provided with a denture which is displaced by muscular contraction of the lower lip during swallowing.)

REST POSITION OF THE TONGUE

It may not be out of place to discuss here another aspect of tongue behaviour. Although it is a very mobile and active organ, it is probable that it does have a "rest position". This hypothesis was put forward by Ballard (1955). He suggested that the control of mandibular rest position and the patterns of activity of the masticatory muscles were endogenously determined at birth and remained stable throughout life, and that the tongue was

similarly controlled. Rix (1952) commented on the constancy of the contact between the lip and tongue in infants, even during changes of facial expression. Ballard (1952), opening the discussion on Rix's paper, pointed out that anatomists had failed to demonstrate any

Fig. 3.—This patient had proclined upper anterior teeth and his lips were apart at rest. Here he is shown wearing a partial upper denture which is æsthetically better than his natural teeth. The lips have been forcibly pulled apart during a swallow to show the forward tongue thrust.

proprioceptive fibres in the tongue, and wondered whether the posture of the tongue at rest in these cases "was maintained by the reflex action of this contact between the tip of the tongue and the lower lip". It is a dangerous practice to search for "reasons" for involuntary physiological processes, but perhaps there may be some association between the lip–tongue contact and the maintenance of a patent airway in infants. Obstruction of the airway is a very great hazard in the first year of life, for the cough reflex is as yet poorly developed, and limb control is insufficient to allow the child to use its hands to clear the obstruction, even if it possessed the reasoning power necessary, which at this age it does not. Some reflex mechanism must therefore keep the tongue forward, whatever the position of the child, and the lip–tongue contact may be part of this protective reflex. If this is so, it would be expected that the tongue, at a very early age, should be attached to a firm and stable base, and it may not be purely coincidental that the mandibular symphysis is united by bone during the first year of life.

Rix's observation, and the theoretical considerations of it, support the suggestion that proprioceptive control of the tongue is maintained mainly by touch sensation. The subject is only aware of the precise position of the tongue as long as it is in contact with some

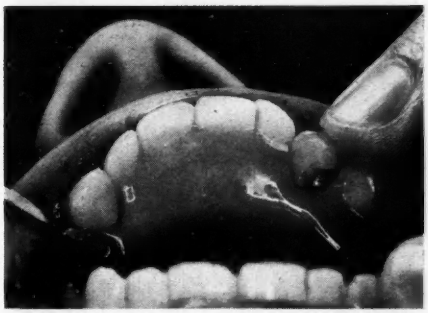

Fig. 4.—The denture worn by the patient in *Fig.* 3. The poor fit of the collets is obvious, but some wear may have occurred due to the denture being rocked forwards and backwards by the thrusting tongue.

Fig. 5.—The palate beneath the rocking denture. Chronic inflammation of the mucosa is present, with a characteristic granular appearance.

structure within the mouth. Clinical observation tends to support this, as does the fact that the tongue is rarely bitten.

The lip–tongue contact in the infant is of course modified as the lower anterior teeth erupt to form a low barrier. In most cases it seems probable that the tongue transfers its anterior contact to the tips or lingual surfaces of the lower teeth. Variations in the precise area of the contact are found, and may possibly be associated with malocclusions, but an

anterior contact does always seem to be present, whatever the age of the subject. Atwood (1958) mentions variations in the position and shape of the tongue at rest. In some cases the dorsum almost touches the hard palate, in others the tongue lies almost flat in

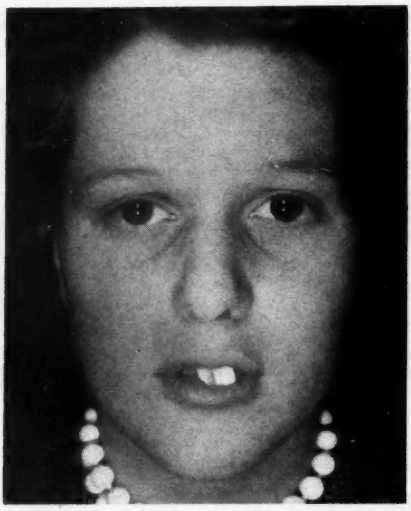

Fig. 6.—These lips are unlikely to change their position, but for various reasons $\underline{21|12}$ must be extracted.

Fig. 7.—A partial denture replacing $\underline{21|12}$ has been fitted. The lip position is unchanged and therefore the æsthetic improvement is not great.

Fig. 8.—The same patient as shown in *Figs.* 6 and 7 after a lapse of several months. She has adopted a habit of keeping her lips forcibly closed, which looks, and is, strained and unnatural.

the floor of the mouth, and intermediate positions can be demonstrated. *Figs.* 9 and 10 tend to confirm the existence of the anterior tongue contact, and also show different tongue postures, but it must be remembered that radiographic evidence obtained in this way is open to question.

However, it is more than likely that the control of the rest position of the tongue is closely associated with the control of the rest position of the mandible. It is now generally accepted that proprioceptive information from the jaw muscles, periodontal membranes, and temporomandibular joints plays some part, probably a large one, in the maintenance of the mandibular rest position. It is not unreasonable to include information on tongue position, which can probably only be available if the tongue is in contact with some structure inside the mouth. If this necessary contact is with the tips of the lower incisor teeth, then when these teeth are lost it would be expected that the mandibular rest position might change

slightly. It has already been shown by Tällgren (1958) that this does happen; also that after full dentures have been fitted, the mandibular rest position is not the same when they are worn as when they are removed.

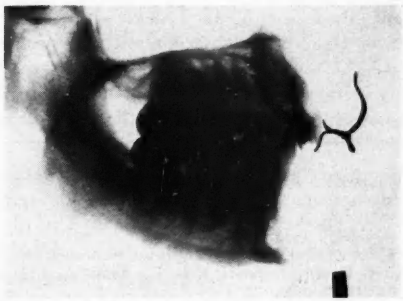

Fig. 9.—Barium paste has been placed on the midlines of the tongue and lips. The tip of the tongue contacts the lower anterior teeth.

As far as full dentures are concerned, the height of the lower anterior teeth, or the site of the anterior tongue contact, is determined by the selection of an arbitrary occlusal plane. Clearly the exact position of this anterior contact is not critical, for any individual patient is usually able to tolerate occlusal planes at different levels, within quite wide limits. Whether an alteration in the occlusal plane, or the position of the lower anterior teeth, is associated with a change in the mandibular rest position remains to be investigated. However, these considerations suggest that it is quite possible that a more accurate assessment of the rest position of the mandible may be made if the edentulous patient has either an old lower denture or even a lower bite-block in the mouth, rather than if the mouth is empty. But complications exist even if this precaution is taken, for experience dictates that older patients are

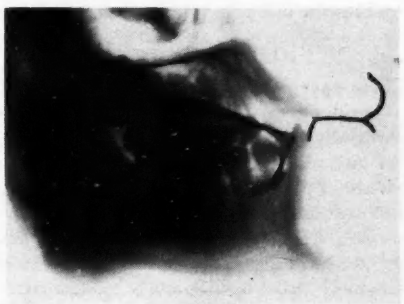

Fig. 10.—Barium paste on tongue and lips. The tongue-tip contacts the lower incisors, although the body of the tongue is held in a different position to that shown in *Fig.* 9. Such radiographs are of dubious validity, for it is impossible to be sure that the tongue is properly "at rest", and also the presence of the barium paste may have some effect on tongue-posture.

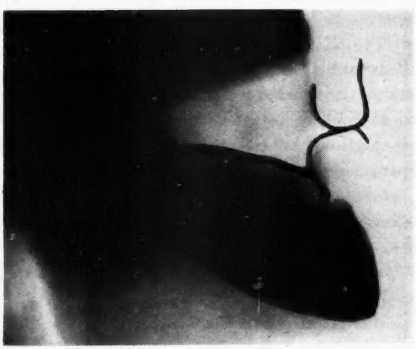

Fig. 11.—Barium paste on lips and tongue of edentulous patient. At rest, tongue-tip contacts inner surface of lower lip.

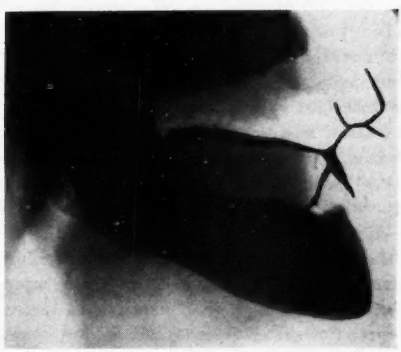

Fig. 12.—The same patient, wearing dentures. The tongue contacts the lower lip above the tips of the lower incisors.

more comfortable with a low occlusal plane, and in the rest position the tongue frequently contacts not the tips of the lower teeth, but the lower lip. (*Figs.* 11, 12.) This contact resembles the infantile tongue resting position.

CONCLUSIONS

These speculations, although they may be of considerable interest, and may appear superficially to be of some significance, cannot be of any real value until more experimental evidence of their validity is produced. But the manifestations of lip and tongue behaviour as described by Rix and Gwynne-Evans have been successfully applied in the clinical assessment and subsequent treatment of many thousands of orthodontic cases. The basic principles are equally applicable to many prosthetic and periodontal problems, and the results are equally encouraging.

Acknowledgements.—We should like to thank Professor A. O. Chick, of the Royal Dental Hospital, for permission to reproduce *Figs.* 6, 7, and 8; also Mr. F. Godman, of the University of Bristol Medical Photographic Department, for his help with the illustrations.

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Effect of Complete Dentures on Palatal Mucosa

The author has investigated common lesions of the palate under complete upper dentures. In the first type described the mucous membrane surface is shiny and bright red and the tissue looks hyperæmic. In the second type the surface shows granulomatous overgrowth.

Biopsies of the mesiodorsal region of the palate were taken from about 400 subjects who were denture wearers or who were about to receive immediate insertion dentures. The author states his conclusions:—

The pressure and friction of the appliance may interfere with normal cornification of the epithelium and result in loss of the stratum corneum. Protection against bacterial and toxic attack disappears. The initial reaction is increased mitotic division and thickening of the tissue. Later accumulation of fluids occur in the intercellular spaces and cell-volume increases. Vacuoles concentrate at the apices of the connective-tissue papillæ. Localized compression of the epithelium leads to small outcropping on the surface. The cells of the stratum spinosum and the fibrillar structure binding the basal membrane to the lamina propria are stretched perpendicular to the surface. Thus, this lesion shows many of the elements of parakeratosis and acanthosis.

Pressure and friction are the common causes of this type of stomatitis and faulty occlusion and articulation may play a considerable part. Treatment comprises the elimination of the traumatizing factors.

The granulomatous lesion of the palate is usually due to suction introduced by suction chambers, deep reliefs, overdeep post dams, or contraction of the denture base away from the model. If the denture is not worn for several weeks the hyperæmia tends to disappear, but the overgrowth of tissue persists. In the interests of hygiene, this may be removed by cautery.

Pressure from the denture base tends to restrict the drainage from the palatal mucous glands leading to stasis and fibrous degeneration of glandular tissue. In the elderly denture wearer this exacerbates the normal reduction of secretory tissue with increased age, and augments the difficulties of retention and the possibility of denture trauma.—OSTLUND, S. G. (1960), *Rev. franç. Odonto-stomat.*, **7**, No. 5, pp. 912–921. M. PLEET

SURGICAL POSITIONING OF UNERUPTED MAXILLARY CANINES

A PRELIMINARY REPORT*

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CALCIFICATION of the maxillary permanent canine commences four to five months after birth high up in the maxilla near the floor of the orbit. The tooth has to travel quite a distance in order to erupt correctly into the arch and its progress has been studied in some detail. Broadbent (1941) in his cephalometric investigations showed that it lies between the roots of the first deciduous molar at 1 year, and has moved forward to lie mesial to them at $1\frac{1}{2}$ years. At $5\frac{1}{2}$ years the crypt of the canine is in contact with those of every permanent tooth from the midline to the first permanent molar (Atkinson, 1943), and although the crown is completed at 7 years it is still within the site of its formation. The tooth appears in the mouth at 11–12 years, and root formation is normally complete 2–3 years later. Its position in the sequence of eruption was defined by Lo and Moyers (1957) as 6,1,2,4,5,3,7.

During eruption it may cause a distal divergence of the crown of the lateral incisor by pressure on its root, later rectifying this as the pressure is transferred to the crown, and this feature is sometimes an aid to diagnosis of impactions.

The æsthetic value of a well-placed canine in the arch is such that no effort should be spared to attain it, and its contribution to facial harmony is emphasized in patients in whom it is missing. Only where the unerupted tooth is in a very poor position for movement, or space is inadequate, is it preferable to extract it, and move the first premolar forward; and almost all techniques depend upon a blend of surgery and orthodontic procedures, unless of course extraction is the only method applicable.

Methods vary from the simple removal of a retained deciduous canine, or first premolar, or even lateral incisor, to surgical exposure of the crown and the creation of a pathway to the surface kept patent with zinc oxide packs. To the last may be added traction by means of a fixed appliance attached to a screw pin in the crown, a cap or band, or a ligature wire.

The technique of surgical positioning introduces the concept of placing the tooth in a one-stage operation, and it is with this method only that this paper is concerned.

The idea is not new and derives from *redressement forcé*, the forcible positioning of malplaced teeth by forceps of the older writers, notably Pierre Fauchard in the early part of the eighteenth century. The modern surgical form of the treatment was pioneered in Boston by Holland (1955, 1956) and successful cases are provided with the newly positioned tooth in a much shorter time than would be possible by other methods, if they were practicable. The great advantage of this method over others is that they are lengthy and tend to fail, not because of inadequate technique, but because of the disappearance of the patient, whose patience and enthusiasm cannot match that of the operator.

SELECTION OF CASES

Most cases referred to the authors have been between 10 and 16 years of age, and although various ages have been treated, the optimum period would seem to be 12 years.

The prognosis must be fully discussed with the parents of the child, for complete co-operation is more important in this than in other techniques. The two primary considerations are the exact position of the unerupted canine

* Paper presented at the annual meeting of the Fédération Dentaire Internationale in Dublin, June, 1960.

and the amount of space available in the arch, because if space is not available no amount of surgical skill or orthodontic ingenuity can succeed.

The conditions which will indicate surgical positioning are, therefore:—

1. Reasonable expectation that, if the tooth is allowed to remain where it is, it may by pressure cause alteration in the position of neighbouring teeth; interference with their apices; or originate bony changes such as dentigerous cysts which may produce similar or worse effects.

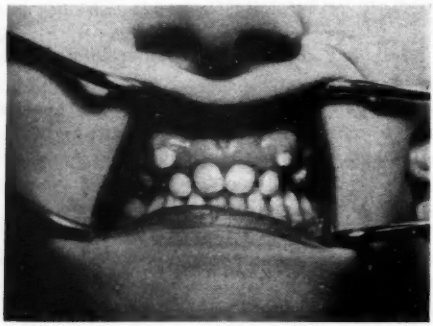

Fig. 1.—Displacement of lateral incisors (*Case* 7).

2. A gap or unsightly buccal malplacement which interferes with æsthetics.

3. An unerupted canine so placed that it is capable of pendular movement.

4. A space into which it can be moved.

5. Healthy periodontium.

EXAMINATION

Inspection.—Either a gap which may be diminished in size, or a retained deciduous predecessor, marks the unerupted tooth and attention should be paid to the axial inclination of the neighbouring teeth. Reference has already been made to the slight distal splay of the lateral incisor which occurs at the early stage of canine eruption due to pressure on its root, and when *impaction* occurs on the distal aspect of the lateral incisor root the distal inclination of its crown becomes marked (*Fig.* 1). Likewise, pressure on the labial aspect of the root will cause labial tilting of the crown, and the premolar may also be deflected in its apical region, causing its crown to move lingually.

Secondly, a bulge may be visible palatally or labially indicating the canine crown; while conversely the absence of the bulge caused by the canine root in the alveolus labially is indirect evidence of malplacement rather than slow eruption.

Palpation.—The crown is frequently palpable labially or palatally as a firm smooth bulge unless the tooth is lying very deeply in the bone, and the two sides of the mouth should be very carefully compared simultaneously.

Vitality Tests.—Apart from the fact that a dead incisor might influence the choice of treatment, it is necessary to establish its presence before surgical interference which might later be blamed for its occurrence.

Radiographic Examination.—Even the most thorough clinical examination in favourable conditions cannot provide all the information required for assessment of these cases and only the radiograph can reveal root curvature and relationships, apical conditions, and bone structure. The interpretation of these radiographs is notoriously difficult because it is complicated by the dual curves of the palate and the arch allied with the frequent dilaceration of the unerupted tooth, and above all, the superimposition of three planes on a flat print. It is clear at the outset that, for accuracy, three films are required:—

1. *Occlusal*: showing the relationship of the canine to the incisor apices on a horizontal plane, and indicating the curvature of the root viewed from its mesial aspect.

2. *True lateral*: showing the height of the apex and its distal extension.

3. *Postero-anterior*: showing the angle made by the long axis of the tooth with the horizontal plane.

Intra-oral films will give much detail of the relationship of the canine crown to the incisor roots, and can be used in addition for the shift technique to ascertain whether the canine lies labially or palatally if it is not palpable.

The occlusal film should be taken as far as possible in the long axis of the incisors, so that their roots appear almost as circles within the

sockets, and the tube is positioned either at the vertex or sometimes the frontonasal suture to accomplish this. In such a view the correct position of the canine labially or palatally is seen, while in the ordinary routine occlusal the labially placed canine will be transposed palatally.

SURGICAL CONSIDERATIONS

The surgical aim of the treatment to be described is to position the unerupted canine in a functional and æsthetic place in the arch without loss of vitality.

In this small preliminary series of thirteen cases aged 10 to 24 years, in which thirteen canines, 2 incisors, and 1 premolar have been positioned, we have confined ourselves to a description of the canine technique (*Table I*).

Table I.—PRELIMINARY SERIES OF THIRTEEN CASES

Case No.	*Age (years)*	*Sex*	*Tooth*	*Classification*
1	7½	F	$\overline{\lvert 2}$	—
2	10	F	$\overline{1\rvert}$	—
3	12	F	$\overline{\lvert 3}$	I (ii)
4	12	M	$\overline{3\rvert}$	I (ii)
5	12	F	$\overline{\lvert 3}$	I (i)
6	12	M	$\overline{3\rvert 3}$	II
7	12	F	$\overline{3\rvert 3}$	II
8	17	M	$\overline{3\rvert}$	I (ii)
9	15	M	$\overline{3\rvert}$	II
10	16	M	$\overline{\lvert 3}$	I (ii)
11	18	F	$\overline{3\rvert}$	I (ii)
12	12	F	$\overline{3\rvert}$	I (ii)
13	24	M	$\overline{3\rvert}$	I (ii)

Totals: CLASS I Subdivision (i) 1
Subdivision (ii) 7
CLASS II 5

PROGNOSIS

This will depend upon the following anatomical factors, keeping sight of the fact that the problem is primarily one of mechanics:—

1. The position of the cusp of the canine.
2. The condition of the apical foramen and its position in bone.
3. The amount of space available in the arch.
4. The bone structure.
5. The periodontal membrane.

1. The Position of the Cusp of the Canine.—Hitchin (1956) surveyed the treatment of unerupted maxillary canines and classified the teeth from the viewpoint of difficulty in extraction. We have modified part of his classification to help as a guide for positioning.

I. *Palatal*: Subdivision (i) between gingival margin and a horizontal plane passing through midpoint of incisor roots. Subdivision (ii) above midpoint of incisor roots.

II. *Labial*: If the apex lies high in the bone the closer the cusp of the unerupted tooth is to the midline the better, because there will be greater scope for pendular movement to the vertical at the required new level (*Fig.* 2 A).

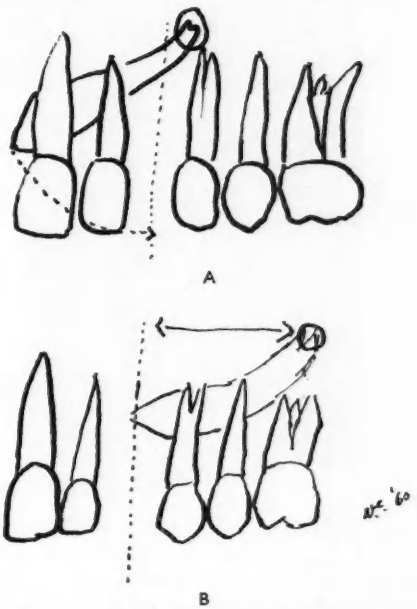

Fig. 2.—A, Suitable case for pendular movement. B, Unsuitable case.

This factor is likely to operate in Class II cases where the horizontal element of malplacement is usually less severe, and the movement required tends to be mesiodistal or buccolingual, rather than the more complicated supero-inferior phase; while in addition the tip will come to lie lower in the arch in the manner of a fully erupted tooth.

At the other extreme, where the apex lies well posteriorly at the second premolar level (*Fig.* 2 B) and the tip does not reach beyond

the distal side of the second incisor, prognosis is hopeless for positioning.

Relationship of the cusp to the roots of neighbouring teeth will play a considerable role in prognosis, since death of the incisor pulps would be a most undesirable complication to the treatment. Fortunately, a good deal of latitude is permissible, as the incisor periapical areas appear to tolerate the trauma very well, and there is often more space than

Fig. 3.—Pulpotomy after three years.

would appear available radiographically due to the bulge of the incisor root, and the presence of the canine follicular sac.

2. The Condition of the Apical Foramen and Its Position in the Bone.—The mass of embryonic mesodermal cells of the dentine papilla is attached to, and will eventually complete the development of, the immature apex. The highly organized blood-supply of this tissue, and the ability of the wider apex to recover from injury and to facilitate collateral circulation, is the kernel of the procedure, for later, when the apex is fully formed, movement at the tiny foramen may cause strangulation of the blood-supply or obstruction of venous return, leading in either case to pulp death eventually.

Histologically, before maturation the periapical tissue and pulp have a cohesive jelly-like consistency well seen at operations for the removal of partly-formed unerupted third molars for orthodontic purposes, when they can be cleanly shelled out of the already calcified tissue of the tooth.

Although the cohesiveness is such that quite considerable movement even of a supero-inferior nature is possible, the operation is

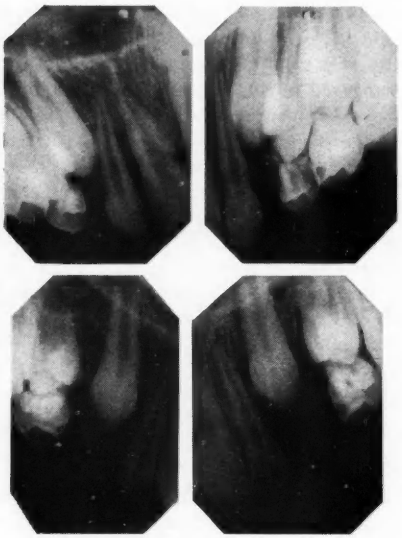

Fig. 4.—Bilateral removal of first premolars and surgical positioning (*Case* 6).

designed to reduce apical deviation in any direction to an absolute minimum; and this is accomplished by swinging the tooth in a pendular manner making every possible effort to have the fulcrum, which is the least disturbed point, at or within a few millimetres of the apex.

From this principle comes the basic surgical requirement—adequate bony exposure, so that no obstruction, especially at the distal side of the apex, will interfere with the free rotation; and it follows that the nearer the apical position approaches a point above the incisor roots in a plane passing through the long axis of the proposed socket, the better the prospects of accurate placement.

The ability of the pulp to recover and provide new blood-supply through the open apex is already well established in vital pulpotomy; and the phenomenon of calcification spreading through the pulp 3 to 5 years after pulpotomy (*Fig.* 3) is sometimes seen in these cases too—a fact which has a bearing on electrical pulp testing.

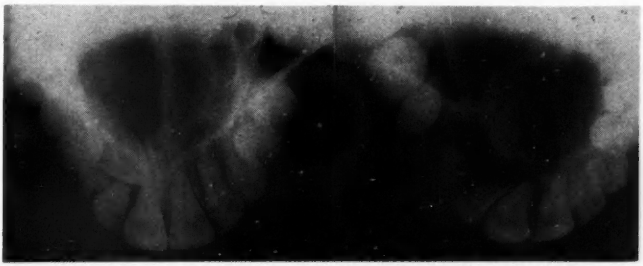

Fig. 5.—Unilateral removal of premolar in an 18-year-old girl (*Case* 11). Occlusal views pre-operative and post-operative.

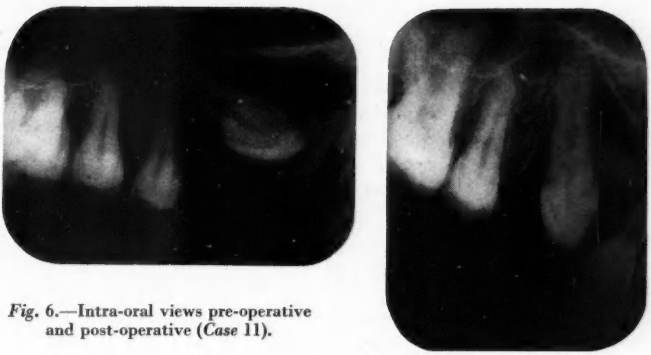

Fig. 6.—Intra-oral views pre-operative and post-operative (*Case* 11).

3. The Amount of Space available in the Arch.—If the tooth is capable of movement the next step is to estimate whether a space is available for it or can be manufactured. The deciduous canine will not provide adequate room on extraction unless there is a total additional gap of not less than 2 mm., and if, in the presence of a normal second incisor and first premolar, this tooth is missing, the gap is invariably too small.

The average maximum mesiodistal diameter of the permanent canine is 7·6 mm. (Sicher, 1952), varying between 7 and 9 mm., and is always less than the incisal width of the centrals (8·4 mm.). A good impression of its size may be gained from its opposite number if present, or from the general shape of the incisors, especially if they are matched up with a set of first-grade artificial teeth.

If the space falls short only fractionally, disking of the proximal surfaces of the incisor or premolar pre-operatively may suffice, and this may be combined with or replaced by slight rotation of the canine as it is moved into place, so that a smaller diameter is presented.

When forward movement of the first permanent molar has caused the reduction in space, extraction of the first premolar is considered, but since failure of the subsequent surgical positioning would then mean a double space, the parents must be made fully aware of the danger at the assessment stage.

If possible, we prefer in such cases to extract the second premolar and move the first premolar distally. Any excess space resulting from this procedure is concealed by the forward

drift of the first molar later. The first premolar has been removed bilaterally in 2 cases (*Fig.* 4) and unilaterally in 2 cases (*Figs.* 5, 6) with satisfactory results, and one illustration of each is shown.

4. The Bone.—If the first factor permitting the treatment is the recovery power of the dentine papilla, the second is the resilience of the young bone, which in the optimum age-group (10 to 14 years) is largely cancellous and enjoys a magnificent blood-supply in the maxilla. This elasticity permits manipulation of the tooth by firm steady pressure, while the blood-supply allows rapid healing.

5. The Periodontal Membrane.—Final retention of the tooth is by periodontal fibres which must re-establish connexion with the bone of the new socket.

In replantation of extracted or luxated teeth much attention is directed to the preservation of periodontal membrane on the root, and this rule is followed, as far as is feasible, in surgical positioning if periodontal membrane is present. Inevitably the membrane will be stripped from part of the root when the bur is passed up alongside to make a track to the new socket, especially near the apex. Happily no ill-effect appears to result even if a little cementum is burred away, provided that sterility is maintained and gingival health is good. Fish (1948) showed experimentally that quite severe damage to the side of a root covered with healthy periodontium and epithelial attachment was followed by organization and re-attachment, presumably because repair cells could work in sterile conditions under a healthy blood-clot. A similar experiment was performed with unhealthy periodontal attachment, and inflammation resulted in epithelial downgrowth to the damaged area with pocket formation; thus it would seem that if the first set of conditions apply in these cases, technique has been adequate.

In short, prognosis is based on good judgement—which is based on experience, which is based on bad judgement.

OPERATIVE TECHNIQUE

Although little can be added to Holland's (1955, 1956) description, it was thought that experience in different countries might justify this account as there is not a great deal in the literature on the subject on this side of the Atlantic, beyond exposure of canine crowds and torsion of single rooted teeth (Hitchin, 1956; Hallett, 1956; Kettle, 1958; Orr, 1959; Hovell, 1958).

Anæsthesia.—All the authors' cases have been operated upon under general anæsthesia

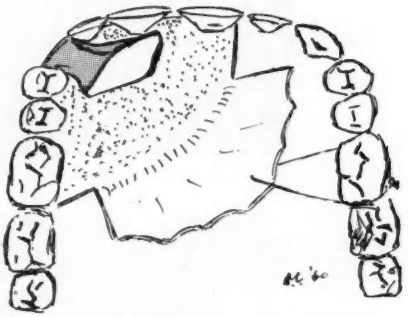

Fig. 7.—Diagram showing palatal flap and exposure of crown.

(thiopentone induction followed by endotracheal nitrous oxide-oxygen), because: (1) young patients tolerate this method better than local anæsthesia; (2) aseptic precautions are efficient when the pharynx is packed off; and (3) more convenient operating positions can be adopted. Local anæsthetic is infiltrated into the flap area to help control bleeding, and then the main horizontal limb of the incision is made. The incision divides the interdental papillæ mesiodistally either labially or palatally, depending upon the position of the tooth. It extends from 0·25 in. beyond the position of the tip of the unerupted tooth to the premolar or molar region palatally or somewhat less buccally. The vertical poles of the incision are made at right-angles at each end, right up to the buccal sulcus bucally, or about 0·5 in. palatally, where too great extension at the posterior end might involve a branch of the posterior palatine vessels (*Fig.* 7). The anterior palatal incision is never made through the centre point, but always in the further interspace to avoid the anterior palatine foramen.

Where bilateral canines are involved, the incision is extended from first molar to first molar around the cervical margins, but only one half of this large flap is reflected at a time so that bone is not exposed for longer than is necessary.

The thick mucoperiosteal flap is carefully elevated and either tied with a stitch to the opposite first molar or retracted by an assistant; and the buccal flap too is released for a short distance if trauma to it is thought likely.

Class I (No. of cases, 8).—In subdivision (i) cases, either the cusp of the tooth is visible at once, or an elevation in the overlying bone is seen, and exposure through this thin layer is easily effected with chisels.

In subdivision (ii) cases, however, there may be no indication of the tooth position at all, and, at first, reliance is placed on the sense of touch using a bur in probing movements indicated by the radiographic positions, when the enamel is quickly identified. Apart from the preliminary stage and the fashioning of the socket later, burring is always used because the slicing type of chisel stroke required is awkward in the palate and the tooth may be damaged or dislocated. The pieces of *chiselled* bone, which are uncrushed, are preserved in a sterile towel for use as chip grafts later.

When the crown has been partly exposed it is convenient to extract the deciduous tooth, if present, and any others which may be involved in the operation plan, and the socket, or sockets, are widened towards the crown position by rongeur forceps and end cutting fissure burs (No. 5). If no teeth are to be extracted, the crown is gradually defined with the bur directly, by passing it along the periodontal space, turning slowly with pressure guided away from the tooth. A round bur (No. 5 or 6) is often more convenient at the early stages, working in a series of concentric advancing movements around the arc of the circumference of the root nearest to the proposed socket, and then this space is widened and channelled away from the tooth to the socket by means of fissure burs. Very often small dentigerous cysts around the crown, or even the soft-tissue sac of the follicle, will create a small space for the drill and are of immense help in avoiding damage to the enamel. The socket itself is fashioned with burs, chisels, and rongeurs, and smoothed with bone files.

The clearance of the channel is extended, largely by touch, as far as the apex, which must be freed completely. The space must be wide enough to accommodate the thickness of the

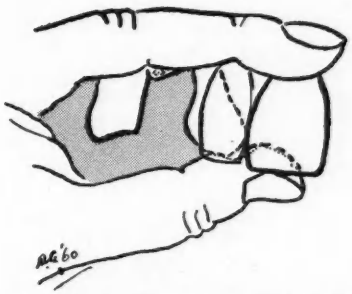

Fig. 8.—"Thumb-snapping" movement for palatal position.

root, on the distal side, so that no obstruction can cause a see-saw movement at the apex, and then a slim straight elevator is worked gently between bone and tooth supero-medially.

Firm pressure with a finger is maintained towards the apex, and very slow, smooth, gentle elevation towards the new socket is commenced, larger elevators replacing the first one in series as the tooth begins to move. If very firm or rigid resistance is felt, the space and clearance are rechecked and adjusted if necessary.

Once it has moved substantially, the tooth and bone are gripped firmly between first finger and thumb, and while the thumb maintains strong apical thrust on the cusp, it also applies sustained pressure in a pinching or "thumb-snapping" action to work the tooth into the new socket (*Fig.* 8). The *sustained* pressure is the key to the manipulation, for although transition occurs very slowly, and may indeed appear not to be occurring at all, it is impressive how the resilience of the bone will allow the tooth to manœuvre its way past, and how the steady force in two directions at

once will automatically cause it to rotate slightly into its optimum diameter.

When it is in place, pressure should be continued for several minutes to allow the apical tissues to adjust themselves; and although the tooth will generally slip back a little when released, the main consideration is to establish that it *can* be positioned without gross strain, and that the sutures will support it in its new socket.

Slight rotation is not unsightly, and one must not overlook the fact that this is a tooth which would not otherwise have functioned at all.

Unless deliberate rotation is required to bring a labial surface outwards, or to assist its passage, forceps are not used on the tooth. Even with a pad there is a danger of popping the conical crown out when the blades are tightened.

Class II (No. of cases, 5).—Technique is similar for buccal placement, except that the "snapping" position is reversed and movement is for the most part easier and shorter. The bite is checked for trauma, immediate and remote, and suitable grinding of the antagonist, or movement of the canine is made to accommodate it. The small chips of bone which were collected are wedged between root and surrounding bone to support the final position and tighten the attachment, and the flap is brought down and trimmed or festooned around the tooth with scissors to fit accurately at the cervical margin. As much of the crown as possible is exposed to prevent the gingiva from closing over it where positioning has had to be "high".

All is then ready for insertion of sutures—black silk 00, taken through the thick palatal mucosa in all cases, and forming the only other aid to retention. The corners of the flap are held first with interrupted sutures to provide anchorage, and then with mattress sutures based on the palatal mucosa (even for labial cases) directed in a variety of combinations through the interdental papillæ and around

Fig. 9.—Palatal impaction (*Case* 3). Pre-operative and post-operative radiographs showing chip grafts, and in lower right film, lamina dura formation at 16 weeks.

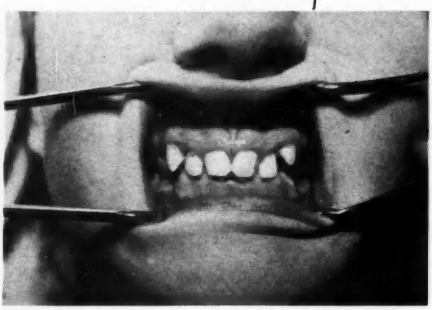

Fig. 10.—Bilateral impaction (*Case* 7). Clinical appearance after 15 months, showing eruption.

neighbouring teeth, rather in the fashion of eyelet wiring for fractures, to provide pressure in the optimum direction. We have not found

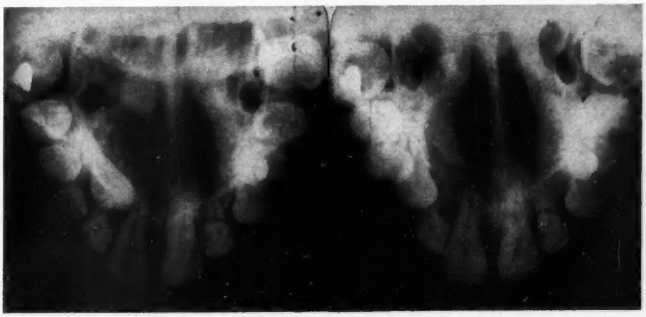

Fig. 11.—Occlusal radiographs, pre- and post-operative, in an 18-year-old girl with palatal impaction (*Case* 11).

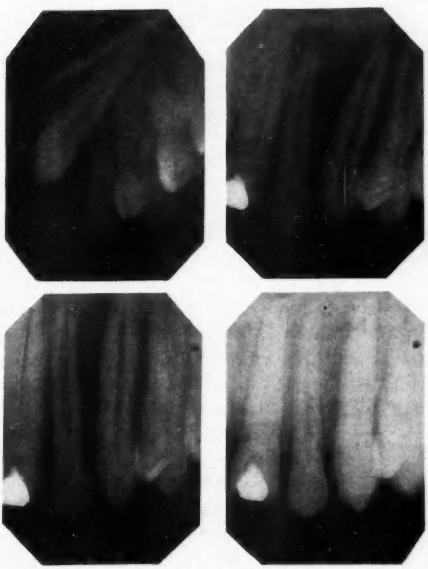

Fig. 12.—Intra-oral radiographs, pre- and post-operative, in *Case* 10. The lower films are 3 months and 7 months respectively, and lamina dura has formed.

additional support necessary so far, but ligature "figure-of-eight" wiring around neighbouring teeth would be our choice if necessary.

Palatal hæmatoma is a painful complication of Class I cases which we have so far been able to avoid, and the precaution taken against it is to massage any serum or loose clot forward through the wound before the last stitches are tied, and then to compress the palatal mucosa firmly against bone with a pack until any residual bleeding stops.

SUBSEQUENT COURSE

Sutures are removed after 5 to 7 days and healing is rapid, especially in palatal cases. If all trauma has been controlled, and the patient restricted in diet to avoid accidental pressure, the tooth shows signs of tightening over a two-to-four week period, after which it is usually possible to relax control a little while the attachment is developing fully.

Fig. 13.—Post-operative view in a 12-year-old female, buccal impaction (*Case* 9).

The bone chips are sometimes accepted or sometimes exfoliated after a month or so, but their purpose is primarily to maintain position, and once they have done this their retention

is of little importance. The epithelial attachment develops cleanly and firmly, the time of its clinical union depending upon whether the chips are accepted or not, the accuracy of the flap contour, and the severity of the operation.

Recession is likely in Class II cases which have had to be placed high because the apex itself was high in the bone, and parents are always warned that eruption to a final position may be pretty slow. Steady progress is maintained, however, and has been observed over periods of up to two years (*Figs.* 9 and 10).

No sensitivity test should be made with the electric pulp tester before six weeks post-operatively. We agree with other workers in any case, that the only reliable test for these teeth is radiographic evidence of lamina dura formation and apical closure, because fibrous or calcifying changes in the pulp may mask electrical tests.

Lamina dura formation is remarkably rapid at the new socket—as little as twelve weeks in favourable cases, but usually sixteen weeks.

CONCLUSIONS

Our limited experience confirms the extensive Boston studies that this treatment is highly satisfactory in suitably selected cases. There is no doubt that extensive pendular movement is possible without reaction if the principle of apical fulcrum is adhered to, and although the optimum age is 12 years perhaps the most satisfying results obtained have been on teenagers in whom the apex was fully developed (14–18 years), and one adult (aged 24 years). (*See Table I* and *Figs.* 11, 12, and 13).

These, and other cases at present under care which are too recent to be included in this preliminary report, have led to the impression that the scope of the treatment is capable of being extended to include older patients than those of the optimum age-group, provided that the surgical indications referred to above are adhered to.

It is necessary to warn against over-enthusiasm for these patients, however, and special care must be exercised to avoid any strain or trauma at the apical region. The criteria for a successful surgical result may be summarized as:—

Firm housing of the tooth with no mobility, a healthy gingival attachment, radiographic evidence of new lamina dura and apical closure, and pulp vitality. To this may be added good æsthetics and function to complete the orthodontic side of the picture. We do not regard æsthetics as a factor capable of contra-indicating operation, provided the other criteria are filled. Even if eruption should be incomplete, and has ceased with three-fourths of its crown showing, after, say, a two-year period, advantage can be taken of the fact that this is a firm vital tooth, and a jacket crown restoration made to produce a fully erupted appearance (Cowan, 1948).

SUMMARY

1. A preliminary report on surgical positioning of unerupted maxillary canines is presented.

2. Reference is made to the difficulty of radiographic interpretation and the problems of assessment of cases suitable for operation.

3. The surgical technique used by the authors is described in detail, with illustrative case-histories.

4. The subsequent course of the cases and the standards by which they may be judged are examined.

5. The possibilities of extending the treatment to cover older patients are mentioned.

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EXPERIMENTAL STUDIES ON REATTACHMENT*

By **HILDING BJÖRN**

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In discussing reattachment it is appropriate first to define as exactly as possible what one means by that concept. Many research workers have tried to prove the possibility of "reattachment" by studying the healing of periodontal wounds, which have been produced by a scalpel, chisel, or bur. The fact that a wound heals when a part of the marginal alveolar bone has been chiselled away, and the defect has been immediately covered by a soft-tissue flap, proves that a wound-healing mechanism is active in the periodontium as in other parts of the body. However, it tells us nothing about the possibility of reattachment.

Fig. 1.—Gingival defect in dog after 6 months.

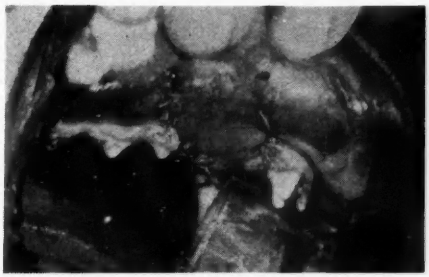


Fig. 2.—Conditions immediately after plastic coverage of the root.

In this paper the term "reattachment" means a reorganization of the periodontium and its different tissue components (cementum, periodontal membrane, and alveolar bone) in cases where there has been a "detachment" for an appreciable time (of the magnitude of months and years) during which some part of the root cementum has been devoid of organic connexion with the other parts of the periodontium.

With few exceptions, experimental investigations on reattachment have been carried out on dogs which did not exhibit any signs of periodontal disease. The results of these investigations cannot be taken as evidence that reattachment is possible in humans suffering from periodontal disease. The value of such animal experiments is limited, but none the less they may be of great interest: they can afford knowledge of those processes of reorganization of the periodontium which are a prerequisite for reattachment even in man.

In clinical therapy, one thing above all others may prevent the practical realization of the ideal of reattachment: that is, the proliferation of epithelium along the root surface. Thereby, a mesenchymal reattachment as just defined is prevented. If it were possible by some means effectively to exclude the epithelium from taking part in the healing process, reattachment would probably be facilitated.

EXPERIMENTAL SERIES I

To study this, two series of experiments were performed. In the first series the soft tissue and bone on the facial side of the maxillary canines in a number of dogs was radically excised to a third of the root length. After a healing time of 6 months a defect in the periodontium remained (*Fig.* 1).

The position of the gingival margin of these defects was marked with a fine bur. The crown of the tooth was then cut off, the root canal reamed, filled, and sealed off by means of a silver amalgam filling in order to prevent bacteria from entering the wound area from

* Presented to the British Society of Periodontology on April 6, 1960, as part of a Scandinavian Symposium. Because of the unavoidable absence of Professor Björn, the paper was read by Dr. W. D. McHugh.

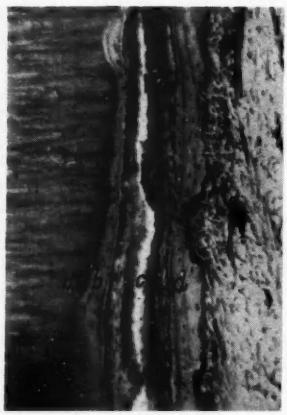


Fig. 3

Fig. 4

Fig. 5

Fig. 3.—Regeneration of the periodontium in a dog. *a*, Dentine; *b*, New cementum layer on resorbed dentine surface; *c*, Regenerated periodontal membrane; *d*, Regenerated alveolar bone plate.

Fig. 4.—Regeneration of periodontium of dog. The secondary cementum has remained attached to the dentine surface where resorption has taken place (*a*) but has been torn away where there has been no resorption (*b*).

Fig. 5.—Resorption of cementum and dentine healed by a new cementum layer. The bur groove can be seen in the lower part of the photomicrograph.

Fig. 6

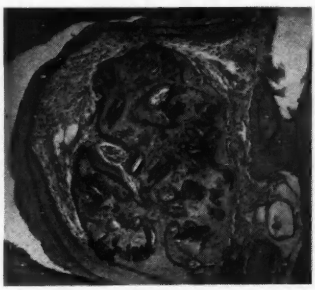


Fig. 7

Fig. 8

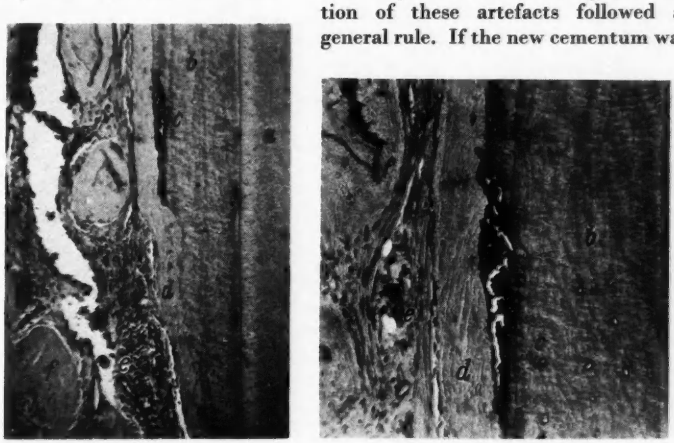
Fig. 6.—Regeneration of periodontium of dog. Alternating artefacts due to shrinkage. Mechanical anchorage of the newly formed cementum in resorption cavities (*a*, *b*).

Fig. 7.—Regeneration of periodontium of dog. This photomicrograph shows the bur groove and newly-formed cementum. Dentine debris in the groove has given rise to hard-tissue formation which has joined the dentine splinters into one mass. Regenerated alveolar bone is seen to the right. There has been no resorption before cementum deposition.

Fig. 8.—Regeneration of periodontium of dog. An accidental cut with the scalpel into the old root cementum has been healed by secondary cementum. The secondary cementum tends to level up irregularities in the surface and reform the original contour. The other components of the reorganized periodontium are also visible in this picture.

the root canal. Thereafter the gingival margin all around the tooth was excised and a soft-tissue flap was raised from the inside of the lip, drawn over the root, and sutured to the gingival wound margin. Immediately after the operation the situation was as shown by *Fig.* 2.

After a healing time of a further 6 months, a block containing the tooth with its surrounding tissues was excised, fixed in formol, and microscopical preparations cut and stained.



A B

Fig. 9.—A, Regeneration of periodontium of dog. Formation of secondary cementum on necrotic primary cementum can be seen. *a*, Dentine; *b*, Primary cementum; *c*, Necrotic cementum; *d*, Secondary cementum; *e*, Regenerated periodontal membrane; *f*, Regenerated alveolar bone. B is a higher magnification of an area from A.

Complete healing occurred in some cases with formation of a new periodontium, including cementum, periodontal membrane, and alveolar bone. In one case new bone formed to a height of 8–9 mm. from the bur mark which indicated the position of the gingival margin before the operation.

The healing had taken place by means of deposition on the tooth surface of a new cementum layer. This was deposited on a root surface that in some areas showed signs of having been exposed to a resorption process, and in others did not (*Figs.* 3–8). These experiments did not reveal which factors determine whether resorption will occur or not. Obviously, infection and denaturation by the heat produced by burs may play a part.

In nearly all histological preparations, artefacts are produced by shrinkage during the histological treatment. Tears appear parallel to the root surface either between the newly-formed cementum and the soft tissues, or between the new cementum and the original tooth substance. The sections tear, of course, where the tissues are weakest, and the localization of the tears, therefore, gives some information about the adhesion between different tissue layers. It is interesting that the localization of these artefacts followed a simple general rule. If the new cementum was formed on an uneven surface where it found mechanical anchorage, as, for example, in undercuts formed by resorption, the tear always took place between the new cementum and the newly-formed periodontal membrane. If, on the other hand, the new cementum was formed on an even cementum or dentine surface—especially a surface devoid of signs of resorption—the artefact was always localized between the new cementum and the underlying tooth substance. *Figs.* 4–6 give examples of these phenomena.

The strength of union was thus less between the new cementum and the original tooth substance than between the new cementum and the periodontal membrane, particularly in areas where no Sharpey's fibres were present.

EXPERIMENTAL SERIES II

In a second series of experiments the technique was different. Periodontal defects were produced as described for the first series. The crown of the tooth was not, however, removed, and the root canal was not treated. The gingival margin around the periodontal defect was excised, a labial soft-tissue flap raised, and simply sutured over the defect. In these cases the epithelium proliferated down along the root surface, but usually not quite to the apical limit of the defect. Some reattachment was therefore produced. Healing always involved resorption and cementum formation, and also included reorganization of periodontal membrane and alveolar bone to some slight extent (*Fig.* 9).

Between the original root cementum devoid of cementocytes and the newly-formed cementum layer containing numerous cementocytes, there was a hyperchromatic area (*Fig.* 9 A). This corresponded to the location of the apical limit of the gingival margin of the periodontal defect, where there was always retention of food debris. Obviously this was incipient cementum caries. The necrotic area, about $0{\cdot}1 \times 0{\cdot}3$ mm. wide, was entirely buried beneath the secondary cementum, and it was followed through the whole series of sections. This necrosis and this probable infection had not prevented the deposition of a layer of secondary cementum.

It has been suggested by some workers that new cementum cannot be formed on necrotic cementum, and that consequently, in order to facilitate reattachment, the surface layer of the denuded cementum ought to be removed during a reattachment operation. This does not seem to be entirely true.

This state is not to be considered a permanent one. The finding represents a snapshot from a series of events. If the animal had been allowed to live it is probable that resorption would have occurred which would have removed the newly-formed cementum, the necrotic area, and probably some of the original cementum in the vicinity. It is also possible that after such a clearing away, a secondary healing by new cementum might have occurred.

SUMMARY

The results of this study can be summarized as follows:—

1. By excluding epithelium from the healing process in the periodontium, it is possible to obtain complete mesenchymal reattachment with reorganization of root cementum, periodontal membrane, and alveolar bone.

2. In cases where the epithelium is not excluded *some* reattachment can be attained.

3. Reattachment can occur even in cases where no attempt has been made to freshen the root surface by removing necrotic cementum,

4. The healing occurs with formation of new cementum either after resorption of cementum, or directly on the old cementum layer, or directly on dentine which has been exposed either by the operation or by resorption.

5. Reattachment has occurred in root-filled teeth. Pulp vitality is not therefore necessary for reattachment.

6. The newly-formed cementum has no intimate connexion to the hard substance on which it is deposited and flakes off relatively easily where it is not mechanically anchored by undercuts.

7. Cementum can form on a necrotic substratum.

A Clinical Parallelometer

The author describes a simple clinical parallelometer. A clamp carrying two guide rods is firmly fixed near the chuck of the turbine and right-angle handpieces so that the rods lie on both sides of the handpiece, parallel to and in the same direction as the bur. A guide rod shaped like an automobile starting handle, the end segments of which are parallel, is fixed with cold cure acrylic in a pit cut into a tooth. The direction of this pit determines the path of insertion of the bridge. The two rods, one in the tooth and one on the handpiece, are connected by a metal arm with short tubes welded to the ends of it. The axes of the tubes are parallel and their inside diameters correspond to the outside diameters of the rods. Alinement is maintained by fitting the tubes on to the respective rods.—MERTENS, CH. (1960), *Actualités odontostomat.*, **49**, 7. M. PLEET

BOOK REVIEWS

RESTORATIVE DENTAL MATERIALS. By FLOYD A. PEYTON, D.Sc., Professor and Head, Department of Dental Materials, University of Michigan School of Dentistry. In association with DAVID H. ANTHONY, D.M.D., KAMAL ASGAR, Ph.D., GERALD T. CHARBENEAU, D.D.S., M.S., ROBERT G. CRAIG, Ph.D., and GEORGE E. MYERS, D.D.S., M.S. 10×7 in. Pp. 542, with 161 illustrations. 1960. St. Louis: The C. V. Mosby Co. (London: Henry Kimpton). 78s. 6d.

IN recent years the teaching of dental materials has taken an increasingly important place in the dental curriculum. The original conception of dental materials as a course in metallurgy related to prosthetics has given way to a broadly based course on all aspects of materials used in dentistry. The importance of the subject cannot be over emphasized, and, indeed, research into the many materials used in restorative dentistry has in fact guided the concepts of cavity preparation into new paths. It is an accepted principle that teeth must be prepared according to the requirements of the material as well as to specific biological standards. An understanding of dental materials is essential to good cavity preparation.

This book on restorative dental materials reflects this approach to the teaching of the subject and is a welcome addition to the literature on this aspect of dentistry. It is exceptionally well produced, easy to read and follow, with reference lists at the end of each chapter. Both the student and the practitioner will find everything they require and to the teacher of restorative dentistry it is essential.

The contents of the book are thoughtfully set out and it deals first with the history and scope of the subject, and then goes through the applied fundamental principles followed by the physical and mechanical properties and the nature of metals and alloys. Each major division of dental materials is then dealt with chapter by chapter. The final chapter on the physical and biophysical applications is extremely interesting (but all too short) and really presents a picture of the wide range of subjects, old and new, which in some form or other may be related to the science and practice of dentistry. This book is worth more than the price and can be well recommended to everyone connected with dentistry.

N. L. W.

THE SCIENCE OF DENTAL MATERIALS. By EUGENE W. SKINNER, Ph.D., Professor of Physics, Northwestern University Dental School, and RALPH W. PHILLIPS, M.S., Professor of Dental Materials, Indiana University School of Dentistry. Fifth Edition. $9\frac{1}{4}\times6\frac{1}{8}$ in. Pp. 636+viii. Illustrated. 1960. Philadelphia and London: W. B. Saunders Co. 66s. 6d.

DR. SKINNER'S text-book on the subject of dental materials has become a classic and a necessity for every student, and, one would hope, for every conscientious practising dentist. The author, whose name during the last 25 years has become synonymous with the text, has been joined by another well-known expert on dental materials, Dr. Ralph Phillips. Together they have created an even more comprehensive review of the basic necessities of dental practice.

The format of the text follows the previous edition, but much revision has gone into each chapter without materially changing the theoretical information, but expanding considerably the clinical applications of the basic knowledge imparted. The most important addition has been the inclusion of chapters concerning rubber and silicone impression materials, tarnish and corrosion as related to dental problems, and a discussion of porcelain to gold restorations as well as cavity liners, calcium hydroxide, cements, and dentifrices.

This text-book still maintains its very high standard and must be recommended to all engaged in the practice of dentistry.

D. D. D.

Continued from page 295.

SOME PROBLEMS FOR CONSIDERATION. II

By R. E. RIX, F.D.S. R.C.S., M.R.C.S., L.R.C.P.

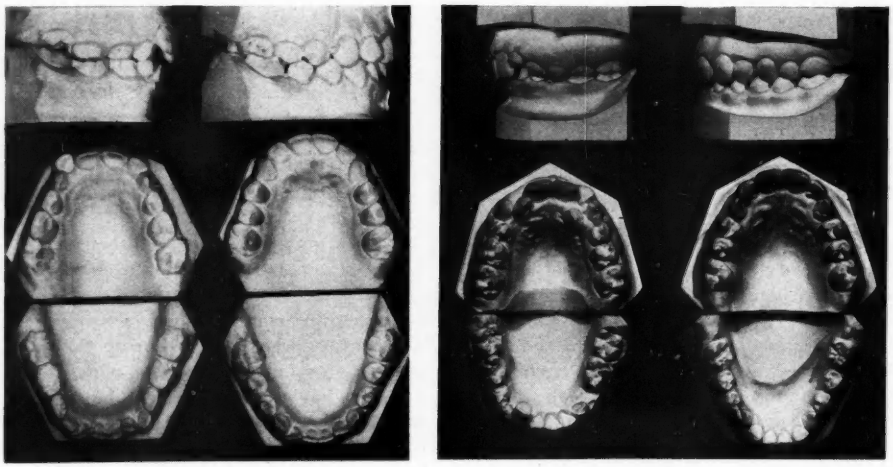
SOME PRACTICAL PROBLEMS

TURNING to a different topic, I think the schools could, with advantage, spend more time in dealing with the problems and disappointments which frequently arise from the poor lasting quality of the first permanent molar teeth. Every few years letters are seen in the *British Dental Journal* from established practitioners either advocating the extraction of all four first permanent molars or stressing that no pains should be spared in patching and preserving them. Practitioners are concerned about a very real problem.

Parfitt (1956) found that 90 per cent of all first permanent molars in London schoolchildren of 9 to 10 years of age had become carious. Wilkinson (1942) is a ready advocate of the removal of all four, providing certain conditions are satisfied, but when he addressed this Society his paper was not accompanied by very adequate illustrations of results. Begg (1956), in more recent times, has been quite ready to extract these teeth, but the subsequent fixed apparatus technique which he uses is too complicated for widespread appeal in this country.

How best to turn the extractions to orthodontic advantage would provide material for a whole lecture. One point of particular interest is the effect, if any, upon the degree of overbite. If the effect is negligible in Class I occlusions the effect will be as negligible in Class II occlusions after treatment has corrected the arch relationship in the anteroposterior plane.

Lundström (1958), in his Northcroft Lecture, said there was no change in the degree of overbite following these extractions, his statement being supported by a paper by Lysell (1957) in which 18 cases were followed up after the extractions were performed between the ages of 7 to 10 years. I have records of 10 cases of



A B

Fig. 5.—A, Case treated by extraction of $\frac{6|6}{6|6}$. No appliances. Models at 8½ years and 12 years. B, Case treated by extraction of $\frac{6|6}{6|6}$ with appliance to guide $\underline{2|2}$ into place. Models at 8½ years and 15 years.

Being the second part of the Fourteenth Northcroft Memorial Lecture given on November 14, 1960.

Class I crowding where all four first permanent molars were extracted early. The average change in overbite was 0·29 mm. increase. Serial profile X-rays would have been useful to demonstrate the effect on the whole dentition, but I have none. One would want to have started the X-rays well before the extractions. I hope some younger man will produce a piece of work on these lines. Broadbent (1943) wrote that the congenital absence of teeth led to a failure of the dental arches and the supporting alveolar bone to approach their normal size and relative position to their maxillary and mandibular bases. By depriving a crowded dentition of the presence of the four 6's quite early, one certainly gets no clinical impression that the upper and lower incisors become markedly retroclined, having lost the buttressing effect of the crowns of all cheek teeth in contact (*Fig.* 5 A, B). One would expect the overbite to deepen considerably if the incisors just fold back.

The conditions necessary to confer some benefit to the dentition without the use of appliances (*Fig.* 5 A) and without leaving much on the debit side following the loss of the four first molars are:—

1. That the extractions should be done between 8 and 10 years of age.
2. That the incisor crowding should be only slight.
3. That there should not be any rotation of the incisors.
4. That the molar relationship should be Class I.
5. That the molars should not, prior to their extraction, have migrated from their rightful place due to early loss of deciduous molars.
6. That X-rays of successional teeth show no abnormality, with special reference to the developmental position of the lower 5's and upper 3's.
7. That the overjet should be acceptable.
8. That the overbite should not be hovering at the point where the gum margins, either upper or lower, could be traumatized.

Obviously many dentitions do not possess these requirements. There are many with arches showing *more* than slight incisor crowding. In these, a serial extraction technique can be employed, providing the E's look like lasting their full term. The four deciduous canines can be extracted at approximately 8 years of age and the incisors left free to drift. Natural improvement is usually sufficient to withhold appliances. The first

Fig. 6.—Case showing mechanical distal movement of $\underline{E|E}$ to enable $\underline{4|4}$ to erupt distally and prevent forward movement of $\underline{7|7}$ following extraction of $\frac{6|6}{6|6}$. $\frac{C|C}{C|C}$ were extracted still earlier to allow natural correction of incisors.

molars can be extracted at 8½ to 9 years of age. Extractions can be staggered, taking $\underline{6|6}$ a few months before $\overline{6|6}$. There is then the real risk of the upper second molars erupting forward enough to deprive $\underline{3|3}$ of sufficient room to drift into good alinement. It is after $\underline{6|6}$ have gone that an appliance is essential. An upper plate can be used with a screw at each side to move $\underline{E|E}$ well distally There is no need to move the $\underline{D}$'s distally too. Following the loss of $\underline{6|6}$, unerupted premolars tend to move distally in face of anterior crowding. A real obstacle to the eruption of $\underline{4|4}$ in a more distal position is the continued presence of $\underline{E|E}$. Move the E's distally and the 4's erupt well distally (*Fig.* 6). Another virtue of moving $\underline{E|E}$ distally is that they will prevent $\underline{7|7}$ erupting too far forward. $\underline{7|7}$ erupt quite early following the loss of 6's, and in the cases I have treated $\underline{E|E}$ have not been shed before the eruption of $\underline{7|7}$.

The upper plate should carry a small anterior incline to reinforce the distal thrust on $\underline{E|E}$ and the screws should be turned weekly, but on different days. A labial bow and boxed-in palatal springs can be added if rotations are present. The bow can stretch from mesial $\underline{D}|$ to mesial $|\underline{D}$.

In the lower jaw it is not always necessary to move the E's distally in a similar way. Lower 7's are slower to drift forward than

their opposite numbers, and there can still be time for premolars to drift distally enough for the more anterior teeth to move into better alinement naturally. Nevertheless, if the lower

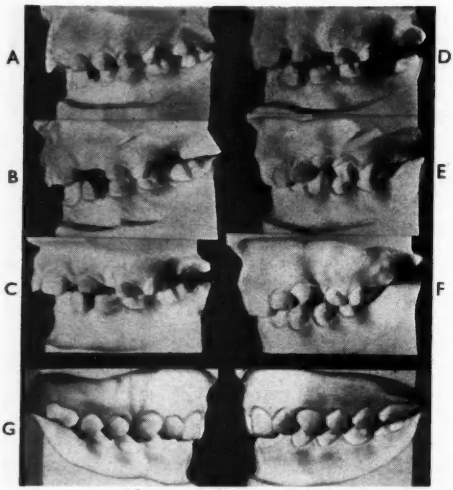


Fig. 7.—Stages in case treated by extraction of $\frac{C|C}{C|C}$ and $\frac{6|6}{6|6}$. A, June, 1955, Models at commencement of treatment immediately prior to extraction of $\underline{C|C}$. B, June, 1956, Extraction of $\frac{6|6}{C|C}$. C, January, 1957, $\underline{ED|DE}$ moved distally. D, August, 1957, Andresen appliance used to remove overjet as anchorage had been disturbed. $\overline{6|6}$ extracted. E, April, 1959, Eruption of premolars into Class I occlusion. F, September, 1959, Eruption of premolars into Class I occlusion. G, September, 1960, Final models showing some slight residual incisor irregularity which could have been corrected had treatment been permitted to continue.

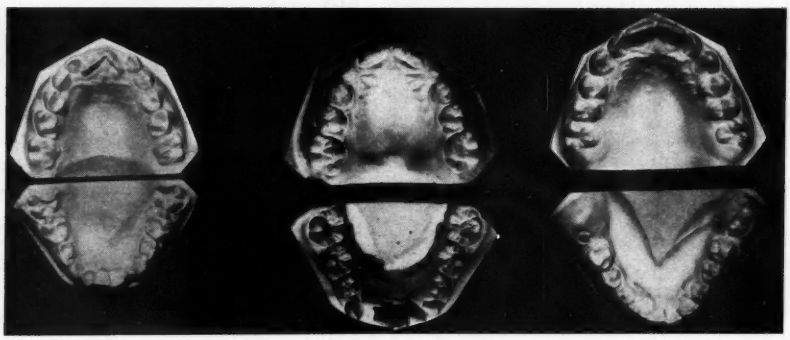


Fig. 8.—Occlusal views of case shown in *Fig.* 7. A, Before treatment. B, After extraction of $\underline{C|C}$ and before $\underline{6|6}$ had been extracted and an appliance used. C, At stage when $\frac{7|7}{7|7}$ were erupting.

lateral incisors, in improving their position earlier, have encroached considerably upon the space left by the extraction of $\overline{C|C}$ then it is advisable that the $\overline{E|E}$ should be moved distally.

Dentitions with all the conditions reasonably favourable for the loss of the four 6's, with the exception of the important condition of a Class I relation of the 6's, introduce further problems.

There is the wretched dilemma in Class II cases of delaying, if possible, the extraction of the 6's until the 7's erupt, so that the upper 7's can be prevented from moving forward while premolars and canines are moved distally. The delay leads to excessive tilting of lower 7's and there is sometimes the doubt that neglected 6's can be kept comfortable until the 7's erupt. There is a way out of the difficulty, providing some simple measures are taken with precision and understanding. Both Angle's Class II, divisions 1 and 2 can be dealt with, though I would not expect complete success with those Class II, division 1 cases with a marked anterior open bite with incompetent lips in association with the visceral type of swallowing behaviour and with a lisp in speech. But, of course, one would make a

guarded prognosis in these cases whatever plan was followed. I have a case here which illustrates the line of thought required, and brings out mistakes that can be made (*Figs.* 7, 8). The 6's were extracted a little earlier

Fig. 9.—Case treated by extraction of $\underline{6|6}$ and Andresen monobloc. First model at 8 years 6 months. Bloc fitted at 8 years 10 months. $\underline{6|6}$ extracted at 9 years 2 months. Second model at 9 years 4 months.

than was probably needed, but by taking very simple measures, Nature was helped to help herself, and the amount of active tooth movement required was reduced. The case is not shown as a high finished specimen typical of the perfection usually shown in print. For perfection, a little more appliance therapy would have been necessary, but the child's parent, at all times anxious to avoid appliances, was content.

I judged the case to be essentially a Class II, division 2 type with considerable crowding. The soft-tissue behaviour was keeping the upper incisors closely related to the lower morsel arch in the anteroposterior plane, though lack of room was preventing the typical Class II, division 2 incisor picture coming into being. Treatment given was the serial extraction of the four C's and the four 6's and the moving back of upper deciduous molars with removable appliances. Starting at the age of 6 years 3 months the extractions were staggered thus (*Figs.* 7, 8): (1) $\underline{C|C}$; (2) $\frac{6|6}{C|C}$; (3) $\overline{6|6}$.

No appliance was used until $\underline{6|6}$ and $\overline{C|C}$ were extracted, by which time (7 months) the rotation of $\underline{1|1}$ had become correct. $\underline{E|E}$ were then moved distally, and the movement carried further than previously described for Class I cases. ($\underline{D|D}$ were also moved distally at the same time and anchorage was disturbed enough to produce an overjet.) Knowing what I know now, there was no need to move $\underline{D|D}$ nor need I have been anxious about the overjet, for it would have corrected itself subsequently.

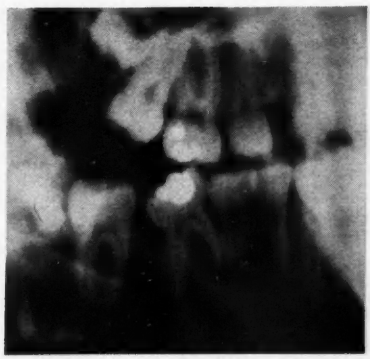
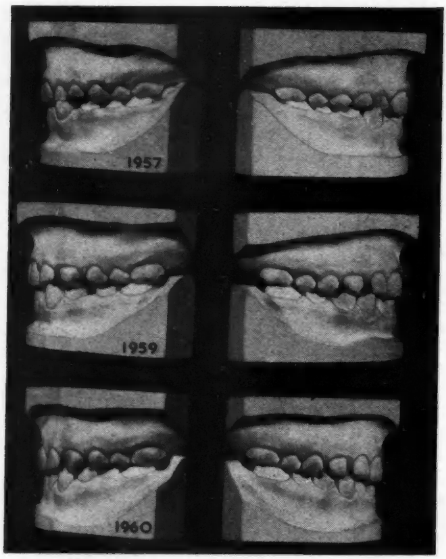


Fig. 10.—Showing possibilities of apical movement of molars with simple fixed appliance as illustrated by X-ray of $\overline{6|}$ in a case where a simple lingual arch and Friel spring was misapplied.

Fig. 11.—X-ray to show good position of $\overline{8}$ after extraction of $\overline{7}$ immediately on eruption.

As it was, I used an Andresen appliance and the overjet disappeared in a few weeks. The appliance, incidentally, served to move $\underline{E|E}$ still more distally. No separate lower appliance was used. $\overline{6|6}$ were extracted one year after $\underline{6|6}$.



A

there is the added advantage that with suitable trimming the lower deciduous molars are not encouraged forwards. I have the bloc at work in the mouth for a month or so before extractions are done to ensure that everything is comfortable and acceptable to the patient and that I am satisfied that it can do its job. A bloc is made more acceptable if a half-moon-shaped window is cut out anteriorly, with the base line just above the lower incisal edges. Orthodox Class II trimming is done on the upper half of the bloc. On the lower half the reverse of orthodox trimming is carried out. The bloc is trimmed out of contact with the *distal* contours of the lower deciduous molars. The upper first permanent molars are then extracted and the bloc trimmed back locally. Resistance to movement of upper cheek teeth is so completely reduced that improvement of cheek teeth relationship is quite rapid.

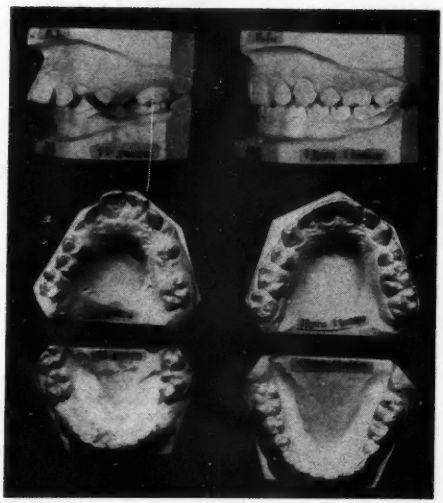
One should be careful not to have a tight labial bow. It should barely touch the incisors. A tight bow concentrates the intermaxillary thrust on to the upper incisors. A loose bow concentrates a distal thrust on to upper deciduous molars, and it is they, and especially the E's, that one wants to move distally. The upper incisors move back none the less

B

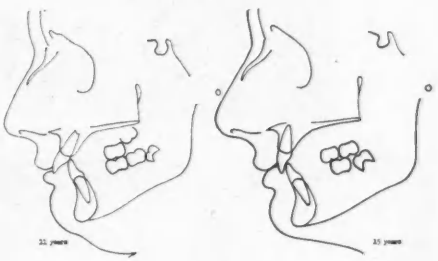
Fig. 12.—A, B, Ideal case treated by extraction of $\frac{7|7}{7|7}$.

In cases of Class II, division 1 some form of intermaxillary traction is essential. I apply it via an Andresen monobloc. I usually have little difficulty in settling it in comfortably and readily with a loosish bow. When the distal border of the upper E's is distal to the distal border of the lower E's the $\overline{6|6}$ are extracted, and again the bloc is trimmed away locally.

The bloc is kept in operation until one is satisfied that the first premolars are going to erupt into a Class I relation, not forgetting that the lower 4's are going to drift distally. I usually step up the distal thrust on the upper E's by either adding a thin layer of cold cure acrylic at intervals to the bloc where it contacts the mesio-lingual surface of the E's or by adding springs to the bloc. Unless springs are positioned and used with precision they are worse than useless.



A



B

Fig. 13.—A, Class II, division 1 malocclusion treated by extraction of $\frac{4|4}{}$ and $\frac{7|7}{}$ at 11 years. No lower appliance was used. B, Tracings at 11 years and 15 years of the same case showing good eruptive position of cheek teeth and stable incisor relationship. Note particularly early and favourable eruption of 8's.

The case shown in *Fig.* 9 shows a response of a Class II, division I occlusion to a mono-bloc which Korkhaus claims to see frequently. This is the only one I have seen. I tried without success to get the patient to bring his deciduous cheek teeth into occlusion.

I should explain that the bloc was trimmed so that there was no hindrance to occlusal rise of the cheek teeth. Korkhaus maintains that the phenomenon is proof that the bloc induces the mandible to move forward or to grow more forward. A more likely explanation, I think, is that the re-adjustments in occlusal level, which ordinarily accompany a change in arch relationship, are taking place somewhat slowly in the deciduous cheek teeth. Deciduous molars not infrequently fail to maintain adequate occlusal rise.

Some mesial tilt of lower 7's can always be seen in X-rays following the extraction of lower 6's, though clinically it is often acceptable. Uprighting requires fixed apparatus and *Fig.* 10 gives a clue to what apical movement can be obtained by using a relatively simple (though often misapplied) mechanical principle. The figure shows how a lingual bow, pressing downwards and forwards on the lower incisors, serves to gather forward the roots of the anchor teeth (the condition was bilateral). The incisors are temporarily proclined into unstable positions. In the example, the anchor teeth were lower 6's and the forlorn aim was permanent proclination of lower incisors.

Another aspect of treatment worthy of more exploration is the extraction of 7's where there is insufficient room in the arches for good alinement. Assuming that the developing 8's are not diminutive, that their inclination is normal, and that the quality of the 6's is satisfactory, there are several conditions where the extraction of 7's can simplify treatment. Just as the early loss of 6's often permits 7's to assume acceptable positions, so the extraction of 7's *immediately on eruption* gives the 8's an equally good chance of gaining an acceptable position (*Fig.* 11). Longer following up of past extraction treatments of this type should enable one to predict with precision the cases

which will respond most satisfactorily as far as the final position of 8's is concerned. Malocclusions, where these extractions can produce a better result with simpler treatment, are found among those with a normal or a Class II relationship of the cheek teeth with only slight crowding in the lower arch at 12 years of age, particularly when there are general tendencies towards retroclination of incisors and deep overbite (*Fig.* 12 A, B). Problems of residual spacing are avoided. The extraction of $\overline{7|7}$ and two upper premolars in slightly crowded arches in Class II, division 1 relation can also be a useful combination relieving one of the necessity of employing intermaxillary traction which would otherwise be required if two lower premolars were extracted instead (*Fig.* 13). Again, where lower 6 has migrated mesially following the early loss of deciduous molars, the extraction of lower 7 will allow an unerupted and temporarily impacted lower 5 to push lower 6 distally and erupt normally, providing its initial position in the X-rays is vertical (*Fig.* 14). This way of disimpacting a

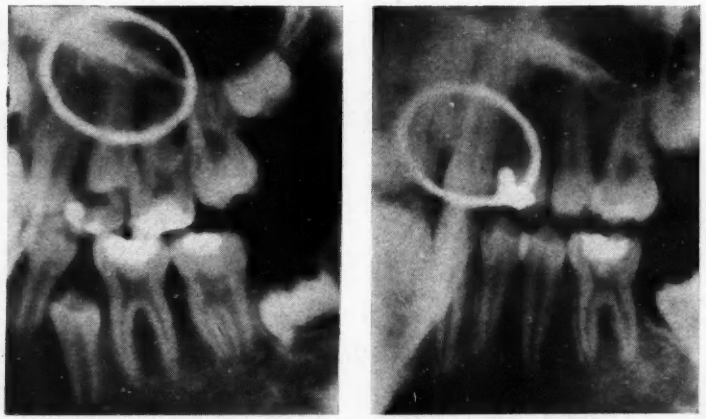


Fig. 14.—X-ray series showing impacted $\overline{|5}$ gaining the lower arch after extraction of $\overline{|7}$.

Fig. 15.—Case showing extraction of $\frac{7|7}{7|7}$ and distal movement of upper buccal segments. No lower appliances. Class II occlusion.

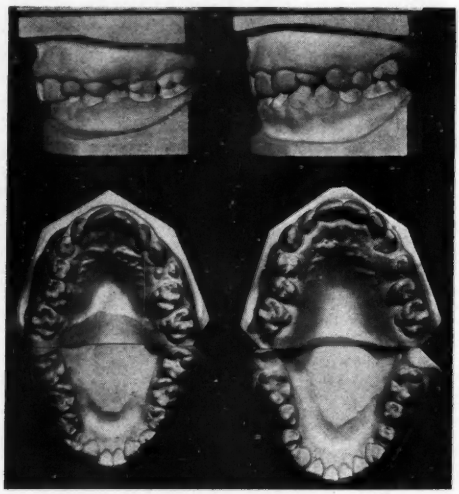


Fig. 16.—Case showing extraction of $\frac{7|7}{7|7}$ and distal movement of upper buccal segments. No lower appliances. $\underline{|3}$ not fully erupted as it was exposed surgically. Mild Class II.

lower 5 can, however, be disappointing and lead to anterior crowding if the distal movement of lower 6 is limited by the over-eruption of upper 7. It can happen where the relationship of the cheek teeth is Class II, but it can be avoided by moving lower 6 distally with an appliance. Alternatively, if an upper appliance is in use as in *Figs.* 15, 16 it can be modified to prevent over-eruption of 7|7. These two cases were Class II, div. 2 type, treated with upper removable appliances only, to move cheek teeth distally and to aline anteriors. An anterior incline was always incorporated. The incline caused a degree of over-proclination of the lower incisors which subsequently relapsed without, however, a return of malalinement.

In conclusion, I hope you can consider this paper in the light of the chronic shortage of dental manpower where it is not helpful for complexity of treatment to increase in order (to misquote Parkinson) to keep pace with the elaboration of apparatus.

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DISCUSSION

Mr. J. H. Hovell said the President had already remarked upon the attendance at the Meeting, which undoubtedly was a sign of the esteem and, indeed, the very real affection which every Member of the Society felt for Mr. Rix. (*Acclamation.*)

The first important point raised was that of the teaching of the basic sciences and pre-clinical subjects. It would seem that no one could fail to agree with Mr. Rix on the basic broad principles underlying his views. He would take issue with Mr. Rix when he said that what was considered to be an adequate background for general dentistry was not an adequate background for orthodontics. Surely the truth of the matter was that the background for general dentistry was inadequate, leading to a poor understanding of problems arising in branches other than orthodontics, and should be raised.

Was it not necessary first, however, to teach the teachers? It would be interesting to hear Mr. Rix's views on a complete integration of the second M.B. and second B.D.S. courses.

In his view Mr. Rix rightly laid stress on the part played by the general practitioner in carrying out orthodontic treatment. How about the consultant? Friel, at the American Association of Orthodontics' Meeting in Washington, had stated that, in his view, the orthodontist should commence his specialized training immediately after, if not before qualification, and should have no contact with general dentistry.

His own view was diametrically opposed to that, even to the extent that he believed the institution of pure orthodontic consultant posts to be a retrograde step—one of the steps which was divorcing dentistry from medicine and reducing it from a science whose most important aspect was diagnosis and treatment planning to something little better than a skilled craft.

In his opinion, before turning to orthodontics a man should spend at least two years in general dentistry and at least two years in a general dental trainee specialist post. His pure orthodontic training should then commence at the senior registrar level.

Where did Mr. Rix stand in that matter?

His own views on soft-tissue patterning coincided very much with those of Mr. Rix. He tended, however, to divide atypical patterns of activity into two main types—innate and habit. The vast majority of those were habit activities, due to and not the cause of malocclusion, and corrected themselves when the malocclusion itself was corrected. They did not in any way hinder successful treatment. He had very grave doubts as to whether the tooth apart swallow was ever *per se* innate. He thought it was rather a swallow commencing from a postured position of the mandible with the cheek teeth apart. It would be interesting to hear Mr. Rix's views on that.

He absolutely agreed with Mr. Rix's remarks on incompetent lips. He had been one of the people who started that red herring and unfortunately that paper of his was still read! He believed that they were of importance only when owing to other aetiological factors, for example skeletal or habit, such as thumb-sucking, the development of a normal overjet or a Class II, division 1 incisor relationship was in the balance. In such cases they might be the determining factor, but not otherwise. Although he considered the effect of normal soft-tissue patterning paramount in the production of normal occlusion and dental relationships, he was tending to discount more and more the effects of abnormal soft-tissue patterning in the production of malocclusion and to consider the skeletal pattern and tooth-tissue relationship to be far more important.

Mr. Rix had given as a basic principle the acceptance of the lower morsel arch in treatment planning. He had not used those exact words himself, but rather the position of the lower labial segment, having due regard to the expected development changes which Mr. Rix pointed out. He thought Mr. Rix's expression was better as it also brought in the necessity of maintaining buccal segments in soft-tissue balance.

He had been pleased to hear Mr. Rix's remarks regarding collapse of the arches after extraction. He did not believe that arches collapsed, but merely found the stable position with soft-tissue balance, when they had previously been buttressed out by interproximal contents, and that movement was in fact a small one. One saw many intact arches which would undoubtedly have been described as "collapsed" had teeth been removed. Had he understood Mr. Rix rightly when he took that to be his view also?

Miss L. M. Clinch said that as a clinician she had picked up some good tips, but probably Mr. Rix would be aware that she was ready to do battle with him on some of the points which he had made. He must have specialized a long time ago, and yet he was now advocating, as

far as she could make out, that all orthodontic treatment should be done by general practitioners. She did not think that would be a forward step and she felt quite sure that many of the general practitioners would not wish to spend so much of their time doing orthodontics. She knew of nobody who advocated that orthodontics should be taken out of the undergraduate course. As a matter of fact, she believed that the development of the dentition and of occlusion was the basis of dentistry, and probably, as things were at the present time, the orthodontic lectures were the most valuable that the undergraduate got in many schools, but she thought that complicated treatment should certainly not be taught as an undergraduate subject. There just was not time.

With regard to the term "incompetent", perhaps it was a weakness of hers but she thought it was a frightfully bad term to use. It was most misleading. What were they incompetent to do? One could masticate with them, one could talk with them; they were competent to do those two things, which were probably the two most important functions of the mouth. She thought it was misleading to graduates and it must be extremely misleading to undergraduates. It was one of the worst terms which had got into orthodontic literature.

Mr. Rix had said that treatment was often based on the morsel surfaces of the lower teeth. Would it be a good thing sometimes to base it on the appearance of the child? That seemed to her to be the most helpful thing to do, and personally she would not diagnose a case from a pair of models.

Finally, what damage did an increase in overbite cause?

Mr. H. G. Watkin: In extracting the first permanent molars Mr. Rix mentioned that the uppers should be extracted first in Class II cases. That was most essential. In taking out the 6's one must take uppers before the lowers in Class II cases, then the lower molars would keep the pre-molars forward and the upper pre-molars would drift into normal position and, in many cases, into normal relationship.

He had been very interested to hear Mr. Rix mention about keeping the 7's back, because it was surprising how soon the upper 7's came forward before one got the 5's back.

Mr. D. G. Timms said he thought that Mr. Rix had rather over-simplified the atypical swallow. He always got the impression from Mr. Rix that in an atypical swallow the cheek teeth were apart. He had carried out a very large number of examinations on atypical swallows and found that was not always so, and very often the teeth were together in an atypical swallow and the tongue thrust was accompanied by anterior open bite.

There was also the question of the extrusion of the tongue. Sometimes one saw an extrusion of the tongue, but it was surprising the degree of the intrusion of the lower lip that had been recorded. Somehow it was sucked in. All these were seen very clearly on cinéradiographic examination—far more so than the normal clinical examination permitted. It was quite important and he hoped that they would be able to publish some of those facts later when they had examined some more cases.

Mr. T. Jason Wood: There were one or two points which he wished to make. Firstly, having had something to do with students over about twenty odd years he had found a very noticeable degree of increase in intelligence and interest with regard to orthodontics, and he thought it was a great pity that the modern tendency was not to allow the students to do anything themselves. He thought that every student should move one tooth over the bite once! (*Laughter.*)

He would not use the term "incompetent lips" because he preferred to use the term "the open lip posture"—it was obvious from the number of children that one saw who had this, that it compared to the number of adults. One had only got to look round a bus or a football crowd in order to see that, and a tremendous lot of it should be disregarded. It was what they called up in Yorkshire a "gawp" and even perfectly normal children had it; one saw them standing round watching a hole in the road being made and standing with their mouths open. He believed that a tremendous lot of it was just immaturity and that they grew out of it.

Professor C. F. Ballard said he thought he ought to stand on his feet because he believed he had detected a hint of criticism of postgraduate teaching! He wished to point out that in papers in the past he had said exactly the same things as Mr. Hovell, and he did not believe that what they had to teach at postgraduate level should be postgraduate teaching at all. He had also said that he did not think it was orthodontics; he thought it was fundamentally a basic teaching of all branches of dentistry, and he had been a little distressed that evening to hear Mr. Rix say that and then appear to retract some of it when he said that the student did not have to be able to assess dental base relationship. He did not think the orthodontic clinician necessarily had to be able to assess the dental base relationship, but he certainly thought the prosthetist had to, and they were teaching, he believed, the fundamentals which the prosthetist had to know and which should come early in the curriculum.

He also agreed with Mr. Hovell in that he did not think the orthodontic consultant was that primarily; he was a dental consultant first and his orthodontics were secondary to that. He entirely agreed with Mr. Hovell that it was essential not to specialize too soon.

Mr. H. E. Wilson agreed with what the President said regarding Mr. Rix's views on undergraduate teaching. He had mentioned how nice it would be to have in the pre-clinical years teachers with some dental background, and that was being brought about. When the undergraduates came into the clinical years, Growth and Development that had, or should have, been taught in their pre-clinical years was reversed and they started by repairing and making appliances for dentureless adults. The curriculum should be changed to follow the logical line, that is, the student ought to follow the child through to the adult during his clinical years. As far as possible, he should start by treating children and watching their growth and development through the clinical years and finally treating the adult.

He agreed, too, that there was a place in general practice for orthodontic treatment. It was not a completely specialized subject, as such. He agreed with Professor Ballard that they should have a general background and not be too specialized.

Mr. W. J. Tulley said that, from the previous speaker's remarks, did Mr. Wilson advocate that the undergraduate course should be ten or twelve years? Apart from understanding the problems of extracting the first molars the undergraduate should have a training in the observation of many cases to get an insight into the way teeth moved naturally following certain extractions in various circumstances. This was something which Mr. Rix had shown him to be all important.

Mr. R. E. Rix, replying to the discussion, thanked Mr. Hovell for his kind remarks about the paper. He had raised very many deep questions and he doubted whether Mr. Hovell had seriously thought that he would answer them all.

In the first place, Mr. Hovell had asked whether it was necessary first of all to teach the teachers. He believed that in the last eight or ten years the ground had shifted so much that teachers were often as confused as examiners, but he supposed that would get better in time. He entirely agreed that orthodontic teachers should have a longer period of training in general dental surgery than they had at the moment. They tended to look at the subject a little too narrowly.

With regard to advocating an entirely separate course; some years ago the Society had set up a Committee to look into orthodontic education and he, with Mr. Chapman, had signed the minority report which left the way open for a less specialized approach to the subject.

In his remarks with regard to swallowing, Mr. Hovell had doubted whether the tooth-apart swallow was ever *per se* innate. His own view was that people did change their mode of swallowing. It was a most interesting subject and he hoped that someone would take 1000 children and 1000 adults and see how they swallowed. He would be pretty certain that there would be fewer adults swallowing with their teeth apart than the children. It looked as though, if one started off with a tooth-apart swallow, it was not necessarily ingrained in one to such an extent that one could never forsake it, but whether it was a "habit", as Mr. Hovell had called it, he did not know if he could entirely agree.

Following on his remarks about incompetent lips Mr. Hovell had gone on to say that it was beginning to be his impression that the skeletal pattern and tissue relationship was getting more important in his mind than the soft-tissue environment of the arches. His own personal opinion was that they both played an equal part. Except in the extreme abnormalities in jaw relationships he did not think that one could disregard soft-tissue behaviour and imagine that it was playing only a minor part.

With regard to Mr. Hovell's remarks about collapse of the arches following extractions, he had an idea that with the *early* loss of, say, the 6's or the congenital absence of 5's the upper incisor apices were not so far forward as they otherwise would have been. It was not only that the crowns fall back because of the loss of buttressing effect, but again one wanted it to be proved with serial X-rays. He did not think that it applied equally in the lower arch. He would deal at leisure with the other points raised by Mr. Hovell.

Miss Clinch had not agreed that all orthodontic treatment should be carried out by the general practitioner. He quite agreed with that because some of the more difficult treatments would not be within his competence. However, he thought the general practitioner should be encouraged to do more useful orthodontics than he was doing at the moment.

Miss Clinch did not like the phrase "incompetent lips" and did not know quite what it meant. He thought that Professor Ballard had given an excellent definition of "incompetent lips", and others had done so several times in papers. As for the very word "incompetent" it was difficult to find an alternative: possibly one could say "inadequate" but he thought that "incompetent" really covered the situation pretty well and he thought everyone knew what was meant by it.

Miss Clinch had said that she would place great stress on the appearance of the patient when deciding upon treatment. Of course one did that, but one had to work within the limits of the individual and there were certain things one could do and certain things one could not do. Miss Clinch had also asked what damage was caused by an increase in overbite. He thought that a deep overbite mattered very little as long as the incisors were not on the point of traumatizing the gums. One of the Society's past Presidents had got a very deep overbite. He still had his full set of teeth—he had had dinner with him that evening.

With regard to the remarks made by Mr. Watkin one could, of course, use fixed appliances, as he had shown, with a lower labial bow.

With regard to Mr. Timms's remarks about atypical swallowing behaviour and the teeth usually together, it all depended upon what one called "atypical swallowing behaviour", he supposed. Some children did in fact occlude their teeth, and the tongue spread through an anterior gap—the endogenous tongue thrust which Professor Ballard had named. He did not quite like the term; although they usually occluded their teeth they did not necessarily invariably do so. From clinical observation he would have thought that a fair proportion of children did not in fact close their teeth during swallowing, and he would have thought that closure of teeth during swallowing was normal and beneficial. Perhaps Mr. Leighton, who had done a lot of work on oral behaviour with X-rays, could say something more about that.

Mr. Jason Wood had pointed out the encouragement that the student got by pushing one incisor over the bite, and he entirely agreed.

On the question of comparing the incidence of the open lip posture in children and in adults, he felt sure that as one grew older there was more and more a tendency for the closed lip posture. The early photographs in his own family album would show him as a "gawping" child to use Mr. Woods's phraseology, but he kept his lips closed now without effort. However, he thought that the real point to decide was whether there was a change in morphology which in the end allowed the lips to be closed without any contraction at all or whether—and he believed that this very frequently happened—the lips did stay closed, but with some slight subconscious contraction going on all the time.

Professor Ballard had thought that he had criticized postgraduate teaching, but he had not. However, he did think that there should be a longer period of general dental experience and he entirely agreed with Professor Ballard that orthodontic consultants were really general dental consultants and made a first-class contribution to dentistry.

Mr. Wilson had felt that children's dentistry should probably come early in the clinical course in the undergraduate schools. That was all right for the undergraduates, but it might not be all right for the children, and he had reservations about it.

LETTER TO THE EDITOR

April 22, 1961

Dear Sir,

Your Editorial in the February issue of THE DENTAL PRACTITIONER interested me immensely, the practice and theory of prosthetics having been part of my life for over forty years.

Dr. Boucher's viewpoint of no "single approach" does not exclude the idea of a comprehensive permutation.

The shortage of technicians and the dependence on dental laboratories have pinpointed the difficulty of imparting correct instructions and a true picture of the desired result in full denture cases.

Tooth manufacturers have tried to help by issuing glossy charts of tooth arrangement which by accident or design all show Class I cases, the simplest of all, and they ignore as if they did not exist the more difficult cases such as Class II and Class III, the student's bogy.

Every operator knows that a wrong bite in a Class I case becomes a Class III, a wrong bite in a Class II becomes a Class I, and a wrong bite in a Class III results in A.D.T., and all mean a complete reset and a wasted effort.

Our real need is a simple basic formula which will give the technician a true picture of the end result from the start. We have available two formulæ which are of some help.

Angle's Profile Bite Classification

Class I	Class II	Class III
Normal	Superior	Inferior
Vertical	Protrusion	Protrusion

Also,

Dr. Leon Williams's Tooth Classification

□ ○ △

Any two of these six is a definite diagnosis of the essentials and the end-result in every case.

For example:—

⊢□ Would mean a normal vertical bite with a square tooth;

ㄣ○ Would mean a superior protrusion with an ovoid tooth;

⊢△ Would mean an inferior protrusion with a tapering tooth.

There is nothing "Picasso" about these symbols, they are all unmistakable natural features obvious to all (except the technician) and once recognized are never forgotten.

There remains, however, the problem of the plane of orientation, e.g., mandibular movement, incorporating the curve of Spee and the Monson plane. The subject is so wide that it seems absurd to reduce it to a formula and a method, but it is possible. This is best illustrated and described.

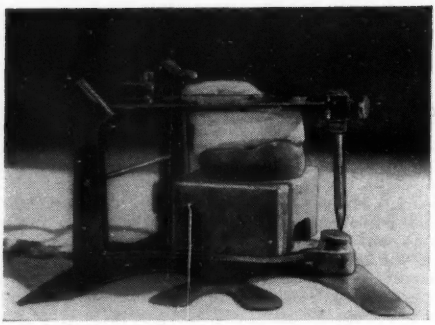

Fig. 1.—Upper bite set to wood block.

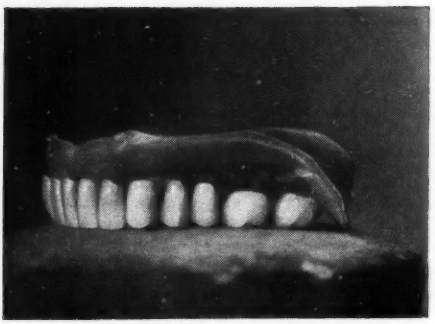

Fig. 2.—Lower denture on "four-inch curved" carborundum stone.

Method: Set the full lower to the occlusal parallel and the neutral spaces of the lip, tongue, and cheeks. Chill and apply the set-up to the abrasive bite plane (a specially prepared carborundum stone with a 4-in. surface curvature). Approximate the distal lower first molars and the occlusal second molars to the curve on the wet carborundum stone and grind gently until all of the high-spot obstructions of smooth lateral excursion are equalized, producing a result which is similar to the facets in a time-worn denture.

Set the upper posteriors to the established plane. This completes the mechanics and allows a free hand for æsthetics of individual choice or copy from pre-extraction records.

An Alternative Method: Set the full upper and lower freehand, adjust the lower to the stone, and reset the upper posteriors.

The articulating block, in wood, measures $3 \times 2\frac{1}{2} \times 1\frac{1}{2}$ in. The stone, made by the British Carborundum Co., can be obtained from E. W. Whiting, 9, Lindale Avenue, Flixton, Manchester.

Yours faithfully,

J. A. COADY

62, *Hyde Road*,
Gorton,
Manchester, 18.